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Introduction

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The following publications are abstracted in *STAR*:

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Volume 7 Number 12 / June 23, 1969

TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories:

page:

01 AERODYNAMICS
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion. **2017**

02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **2019**

03 AUXILIARY SYSTEMS
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **2026**

04 BIOSCIENCES
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **2030**

05 BIOTECHNOLOGY
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. **2042**

06 CHEMISTRY
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **2045**

07 COMMUNICATIONS
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **2061**

08 COMPUTERS
Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics. **2072**

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. 2080

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories. 2085

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations. 2086

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. 2090

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. 2097

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras. 2112

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection. 2119

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State. 2123

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see : 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics. 2124

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. 2130

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers. 2133

20 METEOROLOGY
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. 2145

21 NAVIGATION
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications. 2149

22 NUCLEAR ENGINEERING
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems. 2150

23 PHYSICS, GENERAL
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation. 2161

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation. 2165

25 PHYSICS, PLASMA
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems. 2185

26 PHYSICS, SOLID-STATE
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics. 2190

27 PROPELLANTS
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems. 2196

28 PROPULSION SYSTEMS
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants. 2198

29 SPACE RADIATION
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear. 2204

30 SPACE SCIENCES
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles. 2204

31 SPACE VEHICLES
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. 2211

32 STRUCTURAL MECHANICS
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic. 2214

33 THERMODYNAMICS AND COMBUSTION
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants. 2218

34 GENERAL
Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents. 2223

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-73
CORPORATE SOURCE INDEX I-105
CONTRACT NUMBER INDEX I-125
REPORT/ACCESSION NUMBER INDEX I-133
ACCESSION/REPORT NUMBER INDEX I-145

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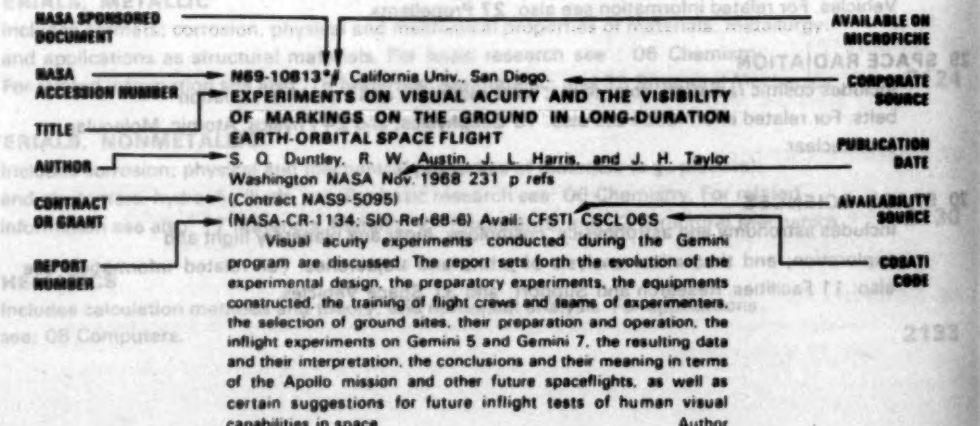
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EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
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S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
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Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

VOLUME 7 NUMBER 12 / JUNE 23, 1969

Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N69-23538*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND TUNNEL INVESTIGATION OF INFLATION OF DISK-GAP-BAND AND MODIFIED RINGSAIL PARACHUTES AT DYNAMIC PRESSURES BETWEEN 0.24 AND 7.07 POUNDS PER SQUARE FOOT

Charles H. Whitlock Washington May 1969 7 p refs

(NASA-TM-X-1786) Avail: CFSTI CSCL 01C

Exploratory wind-tunnel tests of the disk-gap-band and modified ringsail parachute con figurations have been conducted at dynamic pressures between 0.24 and 7.07 lb/ft^2 (11 and 339 N/m^2). Both parachutes exhibited positive inflation characteristics over the range of the tests within technique limitations. The disk-gap-band configuration required less time and distance to inflate than the modified ringsail configuration did. Author

N69-23591 North Carolina State Univ., Raleigh.

THE TWO-DIMENSIONAL OSCILLATING AIRFOIL IN A WIND TUNNEL IN SUBSONIC COMPRESSIBLE FLOW

Samuel Russell Bland (Ph.D. Thesis) 1968 155 p

Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-14644

A method is developed for calculating the pressure distribution on an oscillating airfoil in two-dimensional subsonic compressible flow in a wind tunnel with open, closed, or ventilated walls. The analysis is based on the assumption of small disturbances in an inviscid, irrotational fluid. The resulting linearization of the problem leads to a second order linear partial differential equation for the disturbance pressure potential. The differential equation is solved by the use of the residue calculus. The resulting solution is a singular Fredholm integral equation of the first kind relating the unknown pressure on the airfoil to the known downwash there. The nature of the singularities of the kernel of this integral equation is determined and these singularities are extracted analytically. A collocation procedure is used for the numerical solution of the integral equation. Dissert. Abstr.

N69-23702 California Inst. of Tech., Pasadena.

APPROXIMATE THEORY FOR THE FLOW THROUGH A CASCADE OF CAMBERED AIRFOILS

Mitsuru Kurosaka (Ph.D. Thesis) 1968 143 p

Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-12746

An approximate theory for steady irrotational flow through a cascade of thin cambered airfoils is developed. Isolated thin airfoils have only slight camber in most applications; in cascades, however, the camber is usually appreciable, and significant errors are introduced if the vorticity and source distributions on the camber line are approximated by the same distribution on the chord line. The calculation of the flow field becomes very clumsy in practice if the vorticity and source distributions are not confined to a straight line. A new method is proposed and investigated; at each point on the camber line, the vorticity and sources are assumed to be distributed along a straight line tangent to the camber line at that point, and corrections are determined to account for the deviation of the actual camber line from the tangent line. Hence, the basic calculation for the cambered airfoils is reduced to the simpler calculation of the straight line airfoils, with the equivalent straight line airfoils changing from point to point. The results are compared with numerical solutions for cambers as high as 25% of the chord. The leaving angles of flow are predicted quite well. The method also gives the functional relationship between the exit angle and parameters such as airfoil shape and cascade geometry. Dissert. Abstr.

N69-23769*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OVERALL PERFORMANCE OF A TANDEM-BLADED INDUCER TESTED IN WATER

Richard F. Soltis, Donald C. Urasek, and Max J. Miller Washington May 1969 39 p refs

(128-31-32-12-22)

(NASA-TN-D-5134) Avail: CFSTI CSCL 01A

A 6.5-inch (16.5-cm) diameter inducer composed of tandem blades was tested. Design values of head rise coefficient and flow coefficient were 0.303 and 0.109, respectively. At design flow the noncavitating measured head rise coefficient was 0.278 at a hydraulic efficiency of 0.88. Cavitation caused the head rise to drop off at a suction specific speed of approximately 20,000. It is speculated that cavitation performance could be improved by reducing the blade thickness in the leading edge regions of both blades. The occurrence of cavitation is illustrated in still photographs and the visual observations are correlated with measured results. Small changes to slot geometry were made and resulted in relatively small changes in performance. Author

N69-23781*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF A TWIN-KEEL PARAWING

George M. Ware Washington May 1969 30 p refs
(NASA-TN-D-5199) Avail: CFSTI CSCL 01A

An investigation was conducted in the Langley full scale tunnel to determine the performance and the static stability and control characteristics of a twin keel parawing. The model was essentially an all flexible single keel parawing configuration with a rectangular panel added to form a center section between the triangular outboard panels. The tests showed that the model had a maximum lift-drag ratio of 3.4. The model was longitudinally stable from the minimum angle of attack attainable before nose collapse up to the stall angle, an angle of attack range of about 15°. Changing the length of the aft keel and wing tip lines was effective in trimming the model over the entire unstalled angle of attack range and resulted in a modulation in lift-drag ratio from 2.2 to 3.4. The model was directionally stable, had positive effective dihedral over the unstalled angle of attack range in which the configuration could be trimmed, and had longitudinal stability. At angles of attack above the stall, however, the model became directionally unstable and had negative effective dihedral. Differential deflection of the wing tips produced positive rolling moments and negative yawing moments over the test range of angle of attack when the lines were changed in a direction to lower the right wing tip. Author

N69-23873# Aeronautical Research Council (Gt. Brit.)
FURTHER MEASUREMENTS OF TRANSIENT PRESSURES ON A NARROW-DELTA WING DUE TO A VERTICAL GUST
D. R. Roberts and G. K. Hunt 1968 37 p refs Supersedes RAE-TR-66124; ARC-28190
(ARC-CP-1012; RAE-TR-66124; ARC-28190) Copyright. Avail: CFSTI; HMSO 6s

Transient pressures have been measured on the upper surface of a narrow-delta wing when it passed through nearly sharp-edged upward and downward gusts. Some characteristics of the transient behaviour of the vortex flow on the wing have been identified and discussed. It is shown that a gust-induced loss of lift on this kind of wing develops more rapidly than a gust-induced gain of lift, and thus produces the greater change of loading. Author (ESRO)

N69-23874# Aeronautical Research Council (Gt. Brit.)
LOW-SPEED MEASUREMENTS OF SKIN FRICTION ON A LARGE HALF-MODEL SLENDER WING
L. A. Wyatt and L. F. East 1968 22 p refs Supersedes RAE-TR-67209; ARC-29755
(ARC-CP-1007; RAE-TR-67209; ARC-29755) Copyright. Avail: CFSTI; HMSO 4s 6d

Skin-friction measurements have been made on a half-model slender wing of 24 ft root chord at low subsonic speeds. The maximum root-chord Reynolds number was 30×10^6. The measurements were made using surface pitot-tubes formed by magnetically attaching razor-blade segments to the model surface. The results show that high levels of skin friction are present beneath the leading-edge vortex and are correlated satisfactorily with previous results obtained at lower Reynolds numbers. Author (ESRO)

N69-23884# Royal Aircraft Establishment, Farnborough (England).
TURBULENT FLOW WITH HEAT TRANSFER IN TWO-DIMENSIONAL CHANNELS
I. W. Kaynes Jul. 1968 28 p refs
(RAE-TR-68168) Avail: CFSTI

A theoretical analysis of a turbulent boundary layer over a flat plate based on the use of a universal velocity profile is reviewed and an extension to turbulent flow in two-dimensional channels is derived. The friction and heat transfer coefficients and mass flow rate are related to the bulk Reynolds number and factors are given that extend these relations over a range of nonuniform temperature conditions, the results being tabulated and shown graphically. Author (ESRO)

N69-23892*# General Motors Corp., Indianapolis, Ind.
EXPERIMENTAL INVESTIGATION IN AN ANNULAR CASCADE SECTOR OF HIGHLY LOADED TURBINE STATOR BLADING. VOLUME 3: PERFORMANCE OF TANDEM BLADE
James L. Bettner Washington May 1969 73 p refs
(Contract NAS3-9404)
(NASA-CR-1341) Avail: CFSTI CSCL 01A

A tandem blade consisting of two airfoils was tested in a six blade annular cascade. The performance of this blade was evaluated and compared with that of a plain blade designed to the same set of velocity triangles and tested in the same cascade. The solidity of the tandem airfoil was approximately 91% of the plain blade. By all modes of performance evaluation, the tandem blade met or exceeded the design requirements. Because of flow separation effects, the plain blade consistently fell short of satisfying the design requirements. The tandem blade surface velocity distribution and blade loads agreed well with theoretical values. Suction surface diffusion factor requirements were met or exceeded. High speed flow visualization studies showed that flow separation was prevented to the trailing edge of the tandem secondary airfoil. The tandem hub, mean, and tip blade sections were 1.2, 6.2, and 2.7%, respectively, in excess of satisfying the required change in tangential velocity across the blade row, while the comparable plain blade sections were 9.0, 8.5, and 11.1% deficient. Author

N69-23926*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NEWTONIAN AERODYNAMICS FOR CIRCULAR CONES MODIFIED TO PRODUCE LIFT AT ZERO ANGLE OF ATTACK
Barbara J. Short Washington May 1969 32 p refs
(NASA-TN-D-5193) Avail: CFSTI CSCL 01A

A parametric study was conducted to determine the theoretical aerodynamic characteristics of right circular cones modified to produce lift at zero angle of attack. In the modification, portions of the cone lying above and behind an inclined plane surface were removed. Newtonian impact theory was used to express force and moment coefficients as functions of the manner in which the cone is terminated by this cutting plane at the base. In addition, relationships were formed that allow limits of acceptable design and performance characteristics to be imposed, such as lower limits of useful volume and lift-drag ratios, assurance of maintaining supersonic flow over the trailing edges, and the permissible range of center-of-gravity locations to assure trim at zero angle of incidence. The configurations studied suggest that it is practical to trim cones at a useful level of lift-drag ratio without inclining the axis of the basic cone relative to the airstream. Author

N69-23927*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF A CLASS OF BODIES THAT GENERATE FAR-FIELD SONIC BOOM SHOCK STRENGTH AND IMPULSE INDEPENDENT OF BODY LENGTH AND VOLUME
Raymond L. Barger and Frank L. Jordan, Jr. Washington May 1969 16 p refs
(NASA-TN-D-5148) Avail: CFSTI CSCL 01A

A design method is studied which provides a means of continually increasing the volume of a body without increasing the maximum overpressure or impulse. A sequence of three sonic-boom-generating bodies having length ratios of 1:2.5:4 and

volume ratios of 1:7.6:16.6 was designed and tested. The results of the experiments, together with theoretical considerations, indicate that in the far field, the essential signature characteristics (maximum overpressure and impulse) are virtually the same for all three bodies. Author

N69-24086# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

DEVELOPMENT OF THE ROVER COMPUTER PROGRAM FOR FLOW-INDUCED, SELF-EXCITED VIBRATION OF A BLADE IN A FLOW CHANNEL

R. G. Kennison 26 Jun. 1968 61 p refs

(Contract W-31-109-ENG-52)

(KAAL-M-6926) Avail: CFSTI

The status of the ROVER computer program for flow-induced, self-excited vibration of a blade which is elastically suspended in a flow channel is described. This program includes cross flow around the blade edges in addition to longitudinal flow past the blade. A brief description is given of the operation of the current program and interpretation of the computer output. The analyses and equations for the blade stability conditions used in the program are also presented. Author (NSA)

N69-24265# Aeronautical Research Council (Gt. Brit.)

FORCES ON CONE CYLINDERS AT M = 3.98

K. C. Moore 1968 21 p refs Supersedes RAE-TR-67301; ARC-30294

(ARC-CP-1016; RAE-TR-67301; ARC-30294) Copyright. Avail: HMSO, London: 4s 6d

Normal force and pitching moment have been measured on a number of cone cylinder combinations at a Mach number of 3.98 in the 3ft × 4 ft high supersonic speed tunnel. The results are presented graphically. Comparison is made with theoretical predictions for the same quantities at small incidence based on second order generalized shock expansion theory, and with semi-empirical estimates based on the Data Sheets of the Royal Aeronautical Society. Author (ESRO)

N69-24357*# Hydronautics, Inc., Laurel, Md.

ON FLOW PAST A SUPERCAVITATING CASCADE OF CAMBERED BLADES

C. C. Hsu Feb. 1969 30 p refs

(Contract NAS8-20625)

(NASA-CR-100773; TR-703-5) Avail: CFSTI CSCL 01A

In the study of turbomachines and propellers, one often approximates the actual conditions by considering a two-dimensional flow past an infinite lattice of identical blades. The problem of a fully wetted cascade is well known, but does not seem to be extensively treated for cascades with cavitation. Generally the occurrence of cavitation is promoted by high fluid velocities and relatively low ambient pressures. Both of these conditions prevail in inducer pumps for missiles for example. The purpose of this report is to provide an approximate method for calculating flow of incompressible fluid through a cascade of cambered blades with finite cavities. The difficulty in this case can be appreciated by considering the much simpler problem of incompressible flow past a single supercavitating hydrofoil. The only exact analytical method known, based on certain artificial models of cavity termination, is the hodograph technique, which is rather complex. Author

N69-24427# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

AERODYNAMIC CHARACTERISTICS OF CYLINDRICAL BODIES OF SMALL FRONTAL ASPECT RATIO NEAR AN END-PLATE SHIELD

G. E. Khudyakov Sep. 1968 15 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 1, Mat., Mekhan. (Moscow), v. 23, no. 2, 1968 p 107–111

(Contract Now-62-0804)

(AD-680689; APL-CLB-3-T-568) Avail: CFSTI CSCL 20/4

An experimental study is made of the effect of a plane surface (simulating the ground) on the lift and drag coefficients of circular cylinders of small frontal aspect ratios (height/diameter) at Reynolds numbers of 100,000 to 1,000,000. The cylinders were arranged with their lateral cross-sections (base) parallel to the plane shield (ground board), and their frontal aspect ratios ranged from 0.15 to 1.0. Experimental data are plotted for the dependence of the lift and drag coefficients on the frontal aspect ratio, proximity to the shield, and Re number. Author (TAB)

N69-24663# Ballistic Research Labs., Aberdeen Proving Grounds, Md.

ESTIMATION OF FRINGE LOSS IN THE INTERFEROMETRIC STUDY OF FLOWS OVER BLUNT BODIES

George D. Kahl and Sedney Raymond Nov. 1968 17 p refs

(AD-680208; BRL-MR-1947) Avail: CFSTI CSCL 20/4

A simplified model is used to fix permissible experimental tolerances for obtaining suitable interference fringes in the fore region of axisymmetric blunt bodies in free flight. Two examples are demonstrated. Author (TAB)

N69-24664# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AERODYNAMIC CALCULATION OF THE FLOW IN AXIAL-FLOW TURBOMACHINERY

M. I. Zhukovskii Apr. 1968 338 p refs Transl. into ENGLISH from the Book "Aerodinamicheskii Raschet Potoka v Osevykh Turbomashinakh" Leningrad, Mashinostroyeniye, 1967 287 p

(AD-680030; FTD-MT-24-68-68) Avail: CFSTI CSCL 10/1

The basic position of aerodynamics of turbomachines are given in the book. The problem of three-dimensional flow of a working medium in bladed apparatuses is examined, and methods of calculation of two-dimensional flows are given. The flowing around of airfoil cascades is investigated, and the methods of their designing are given. There is discussed the general theory of flow of a working medium in blade apparatuses of turbomachines in its contemporary state. Examples of the solution to the basic problems are given. On the basis of the discussed methods of calculation, it is possible not only to improve the aerodynamics of the blades but also consider the mutual influence of the stages and calculate the universal characteristics. One chapter is devoted to methods of calculation of foil cascades obtaining widespread use in turbine constructions, which were founded on the solution of integral equations. The final chapter discusses the method of designing subsonic and transonic airfoil cascades. Examples of the calculations are carried out in the international system of units. Author (TAB)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N69-23449*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HEAVE RESPONSE OF A PLENUM AIR CUSHION INCLUDING PASSIVE AND ACTIVE CONTROL CONCEPTS
Jack D. Leatherwood, Grayson V. Dixon, and David G. Stephens Washington May 1969 44 p refs
(NASA-TN-D-5202) Avail: CFSTI CSCL 01C

An analytical and experimental investigation was conducted to determine the heave (vertical) response characteristics of an open-plenum air cushion suspension to simulated guideway inputs. In addition, passive and active control concepts for attenuating undesirable heave responses were considered. Analog computer solutions of the linear and nonlinear equations of motion were obtained and compared with experimental data. Results of analysis and experiment defined cushion resonant response conditions at which guideway inputs may be greatly amplified in the absence of cushion control. With control, however, the analysis suggests that heave responses may be significantly attenuated for a relatively wide range of guideway inputs. Author

N69-23472# Advisory Group for Aerospace Research and Development, Paris (France).
FOURTH AGARD ANNUAL MEETING
Sep. 1968 85 p Presented at the 4th AGARD Ann. Meeting, King's Coll., Cambridge, England, 12–13 Sep. 1968
Avail: CFSTI CSCL 01B

A description was presented by British experts of the state of aeronautical research in the UK for Universities, in Government Research Establishments and in Industry. These were followed by addresses by the Minister of State in the Ministry of Technology, by the Chairman of the NATO Military Committee and by a member of the USAF Scientific Advisory Board. A joint paper on International Research Establishments by the Chairman of the Board of Direction and Mr. Dietz of the von Kármán Institute was followed by a forum discussion. Author

N69-23525# Federal Aviation Administration, Washington, D. C. Information and Statistics Div.
GENERAL AVIATION STATISTICS: HOURS AND MILES FLOWN, NUMBER OF AIRCRAFT, FUEL CONSUMPTION, PRODUCTION, ACCIDENTS, AND AIR TAXI
Feb. 1969 17 p
Avail: Issuing Activity

The data are arranged in tables and reflect aircraft registry as of December 1967 in states, regions, and totals for the United States. Hours and miles flown, fuel consumption, accidents, aircraft shipments, and taxi operations are also given for either all years since 1950 or for selected years. In addition, a forecast is presented of the number of eligible general aviation aircraft for some years up to 1978. K.W.

N69-23717# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
COCKPIT NOISE INTENSITY: FIFTEEN SINGLE-ENGINE LIGHT AIRCRAFT
Jerry V. Tobias Sep. 1968 9 p refs
(AM-68-21) Avail: CFSTI

Fifteen of the most popular single-engine general-aviation light aircraft were tested for the noise intensity present during normal cruising operations at 2000, 6000, and 10,000 feet MSL (mean sea level). In comparison with currently accepted DRC (damage-risk criterion) curves, the noise levels found even in the quietest plane tested could be damaging. However, a well fitted pair of earplugs should protect against the physiologically damaging noise intensities encountered in this study. Author

N69-23872# Aeronautical Research Council (Gt. Brit.)
AN INVESTIGATION OF THE FEASIBILITY OF RESHAPING STICK COMMANDS TO IMPROVE HOVERING CONTROL OF UNSTABILIZED JET-LIFT AIRCRAFT
R. Wilson, (Queens Univ., Belfast) 1968 24 p refs Supersedes ARC-28532
(ARC-R/M-3552; ARC-28532) Copyright. Avail: CFSTI; HMSO 10s 6d

The report examines the feasibility of improving hovering control of unstabilized jet-lift aircraft by reshaping stick commands. From basic theoretical considerations it is shown that the open-loop properties of any linear dynamic system operating in an environment without external disturbance can be altered to those of a lower order system by means of a suitable shaping function. Thus there may be numerous shaping laws which, in principle, could simplify control of hovering aircraft. However, it is felt that practical applications of the concept would depend upon the performance of the mechanical system, which must operate under the limitations of control power available and which must satisfy certain safety requirements. A hydraulic integrating mechanism designed to meet such conditions was chosen for detailed study. Simulated hovering flight studies were conducted to observe the effect of variations of mechanism parameters on pilot performance and a discussion on optimum controls is included. A practical hovering control circuit for jet-borne vehicles was thence proposed on the basis of a compromise between mechanism characteristics desirable for normal operation and those that would be necessary to provide adequate control in the event of hydraulic failure. Author (ESRO)

N69-23893*# Dunlap and Associates, Inc., Darien, Conn.
HUMAN FACTORS PROGRAM FOR THE COOPERATIVE PILOT WARNING INDICATOR SYSTEM Final Report
Leroy L. Vallerie and Roland C. Casperson 31 Dec. 1968 32 p refs
(Contract NAS12-2013)
(NASA-CR-86143; BSD-68-689) Avail: CFSTI CSCL 01C

A study was conducted under controlled laboratory conditions using an aircraft simulator to assess the effectiveness of four types of displays for presenting pilot warning information. Displays investigated were a simple auditory alarm, the matrix display, the hedge display, and the Dunlap auditory display (DAD). Based on the results of the study, it appears appropriate to conclude that visual surveillance of outside airspace has a detrimental effect on control performance and the PWI displays can be successfully employed to aid pilots in detecting and locating aircraft. Simulator pilots were able to detect and locate both single and multiple targets with the greatest speed using the matrix display. Visually searching for targets with this display also produced an insignificant reduction in control performance. There appears to be little, if any, difference in detection speed between the matrix and hedge displays when used to find single targets. The matrix display, however, is significantly superior to the hedge display when multiple targets (two or three) appear simultaneously. Author

N69-23909# Southampton Univ. (England). Inst. of Sound and Vibration Research.
HELICOPTER NOISE
John W. Leverton *In* AGARD Helicopter Propulsion Systems Jun. 1968 18 p refs (See N69-23976 12-28)
Avail: CFSTI

The overall noise spectrum of a helicopter is very complex since it consists of several noise producing mechanisms. The relative importance of these noise sources is discussed with particular reference to the external noise generation of a helicopter. Rotational noise, vortex noise and blade slap are reviewed in light of recent experimental and theoretical investigations. Observations on the present method of predicting helicopter noise, together with their limitations, are also included. Experimental results from full scale

and model tests are given. These show that in many cases the region traditionally referred to as the vortex region consists of discrete frequency as well as broadband noise. Results are also presented to indicate the main rotor rotational noise as a subjectively significant noise source on many helicopters. The problems of measuring and analysing helicopter rotor noise are also briefly outlined. Author

N69-24001# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Energetics Research Lab.
MICROSCOPIC PARTICLE SEPARATION AND APPLICATION
Robert Poplawski and Roger A. Miller *In* AGARD Helicopter Propulsion Systems Jun. 1968 42 p refs (See N69-23976 12-28)
Avail: CFSTI

The theory, equipment, and experimental results from ultramicroscopic particle separation studies, as applied to protection of turbine engines from dust and/or sea spray, are briefly discussed. Field testing results on selected units are also presented. The important trade-offs between design parameters and the selection processes required to tailor a specially designed dust separator to a specific application are discussed, and other important areas of application are suggested. Author

N69-24003# General Dynamics/Convair, San Diego, Calif.
WIND TUNNEL INVESTIGATION OF A CIRCULATION CONTROLLED AIRFOIL ROTOR CONCEPT Final Report, Mar. 1966–Dec. 1968
W. H. Gallaher, P. S. Tyler, and M. T. Harvey Dec. 1968 164 p refs
(Contract N00014-66-C-0272)
(AD-680464; GDC-DCD68-009) Avail: CFSTI CSCL 1/3

A 6 foot diameter rigid rotor, employing circulation controlled blades, was tested in an 8 x 12 foot low speed wind tunnel. Circulation control was generated by injecting gas tangentially from slots in the two circular cylinder blades. The tip jet driven model was tested as a propeller and in the normal helicopter mode. Tip speeds up to 440 fps were attained for the model operating in the propeller mode, while advance ratios up to 0.8 were attained in the helicopter mode. A computer simulation of the rotor model was used to analyze the wind tunnel results. Comparison between selected wind tunnel results and the computer simulation are presented. Agreement between selected propeller mode results and the computer simulation was obtained by using peak inflow velocities measured by a high resolution pitotstatic probe. The correlation between the helicopter mode tests and the computer simulation is commensurate with the large model to tunnel ratio and the present model support system. Author (TAB)

N69-24080*# Techtran Corp., Glen Burnie, Md.
PRELIMINARY INVESTIGATION OF PROBLEMS POSED BY CABIN PRESSURIZATION [ETUDE PRELIMINAIRE DES PROBLEMES POSES PAR LA PRESSURISATION CABINE]
Washington NASA Apr. 1969 4 p Transl. into ENGLISH from French Rept. of Comm. Perm. Du Transport Supersonique (Contract NASw-1695)
(NASA-TT-F-12305) Avail: CFSTI CSCL 01C

Various causes and effects of cabin pressure loss are analyzed, and emerging procedures are recommended for each case. Author

N69-24184*# Aeronautical Research Associates of Princeton, Inc., N.J.
EFFECTS OF ATMOSPHERE, WIND, AND AIRCRAFT MANEUVERS ON SONIC BOOM SIGNATURES
Rudolph C. Haefeli Apr. 1969 116 p refs
(Contract NAS1-8490)
(NASA-CR-66756) Avail: CFSTI CSCL 01C

Sonic boom propagation in a horizontally stratified atmosphere is computed for a broad scope of atmosphere and flight conditions, using both a fighter-type (F-104) and an SST-type (SCAT 15-F) aircraft. Atmospheric conditions include various temperature inversions, lapse rates, and wind profiles. Flight conditions include variations in aircraft altitude and Mach number, together with maneuvers of steady flight, longitudinal acceleration, pullup, pushover, and circular turns. A computer program yields the entire sonic boom signature, with its proper distortion (aging) in either uniform or nonuniform atmospheres with winds, and accounting for any specified aircraft maneuver. This program gives output in both tabular and graphical formats, including plots of the resulting sonic boom pressure signature with shock waves properly located. Results of the calculations are presented and discussed. Author

N69-24222# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Hamburg (West Germany). Institut fuer Flugmedizin.
METHODOLOGICAL PRINCIPLES AND PROPOSAL FOR IMPROVING THE METHODS PROVIDED FOR THE SELECTION OF FLYING PERSONNEL [METHODOLOGISCHE GRUNDLAGEN UND VERBESSERUNGSMOEGLICHKEITEN DIAGNOSTISCHER VERFAHREN ZUR EIGNUNGSAUSLESE VON FLIEGENDEM PERSONAL]
K. Steininger Mar. 1969 31 p refs In GERMAN; ENGLISH summary
(DLR-MITT-69-03; DVL-873) Avail: CFSTI

Personnel selection as one of the means of the personnel management is considered as effective to optimize the employment of flying personnel only by integrated application with other important media of managing personnel. The analysis of job requirements and the development of criteria suitable enough to measure objectively the flying performance are described as basic requirements to increase the effectiveness of selection methods. The possibilities to improve and develop the concerned psychological tests are discussed. Author

N69-24230# Advisory Group for Aerospace Research and Development, Paris (France).
PROBLEMS OF THE COCKPIT ENVIRONMENT
Nov. 1968 97 p refs
(AGARD-ES-4) Avail: CFSTI

Conference papers emphasized the problems of determining crew capability under stress, information transfer requirements, crew training, cockpit design, and information displays. For individual titles, see N69-24231 through N69-24256.

N69-24231# United Aircraft Corp., East Hartford, Conn. Sikorsky Aircraft Div.
SPECIAL MAN/MACHINE CONSIDERATIONS FOR LARGE HELICOPTERS
D. E. Cooper and L. S. Szustak *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 2 p (See N69-24230 12-02)
Avail: CFSTI

Recent theoretical work on several Sikorsky aircraft is presented, along with flight test experience, with regard to aircraft configuration, pilot cues, and control system characteristics. Ways of reducing hysteresis, lags, nonlinearities, and friction in high speed helicopters are considered. A flight evaluation of a side arm cyclic controller, as a replacement for the conventional helicopter cyclic control stick, is described. The introduction of forces into the longitudinal stick, to improve maneuvering characteristics and high speed handling qualities, is discussed. A test program was

undertaken to determine which force parameter, or combination of parameters, produce the best handling characteristics. Early test indications show the feedback of force proportional to aircraft pitch rate and stick position gradient, as a function of dynamic pressure, as the most desirable. Operating environment considerations in relation to pilot capabilities are also examined, including the effect of the pilot's location on his ability to discern and utilize kinesthetic cues, the importance of good downward visibility, and the question of how much reliance on automatic stability an aircraft should have. P.A.B.

N69-24232# Royal Aircraft Establishment, Farnborough (England). Human Engineering Div.

OPTIMISATION OF THE COCKPIT ENVIRONMENT AND THE CREW-COCKPIT INTERFACE

J. M. Shaw and G. R. Allen *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 2 p (See N69-24230 12-02)

Avail: CFSTI

Three problem areas are considered to illustrate how the problems of cockpit environment and crew-cockpit interface are being handled and to highlight certain necessary prerequisites for successful optimization. The following approaches to the problem of thermal effects are recommended: investigations of the basic mechanisms whereby a crew member's mental performance may be impaired, aircrew clothing and equipment development, equipment testing under conditions where the subjects perform realistic aircrew duties, and overall consideration of the conditions and equipment which affect aircrew thermal stress. Vibrations which affect aircrew comfort, fatigue, and performance are investigated. This problem should be attacked on three fronts: the measurement of vibrations experienced in flight and the correlation of these findings with calculated predictions, the observation of pilot performance in accurate simulations of real aircraft subject to various vibration levels, and the detailed investigation of the mechanisms whereby the pilot's performance is affected. A study of cockpit layout must include the compiling of a list of mission tasks, task allocation among the crew complement, and measurement of work loads and levels in terms of mission success rates. More complete cockpit simulation is needed to achieve these goals. P.A.B.

N69-24233# Systems Technology, Inc., Hawthorne, Calif.

FLIGHT APPLICATION OF A THEORY FOR MANUAL CONTROL DISPLAY SYSTEMS

W. F. Clement, H. R. Jex, and D. Graham *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 4 p (See N69-24230 12-02)

Avail: CFSTI

An analytical understanding of the various ways in which the pilot can function as a controller and instrument monitor is the basis for a theory of displays. The understanding is used in the display design/evaluation process to achieve a description of the interactions among the pilot, the display system, and the vehicle. A combination of multiloop analysis techniques, multiloop pilot response models, and the scanning and sampling perceptual model provide the means for the calculation of the quantities to be displayed, the pilot's behavior, system performance including the pilot's workload, and the preferred arrangement, in the case of simple integrated head-up or head-down displays and segregated instrument displays. In an application to design of a visual display system for aircraft instrument landing approach, the theory reveals strong interactions among the numerous factors involved, such as task performance criteria, guidance inputs, disturbances, multiloop dynamics, pilot's display scanning effects, system performance, and pilot workload. The face validity of the results is strengthened by the particular display feedbacks revealed as best, the high scanning workload requirements, the reasonable error levels and frequency band widths, and the similarity of the derived display arrangement to airline practice. Author

N69-24234# Cornell Aeronautical Lab., Inc., Buffalo, N. Y. Avionics Dept.

PROBLEMS OF INFORMATION TRANSFER IN THE MODERN JET COCKPIT

William C. Schultz *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 4 p (See N69-24230 12-02)

Avail: CFSTI

The problem of gaps existing in the transfer of information to a jet aircraft pilot, resulting in the pilot's lacking sufficient information to identify potentially dangerous flight conditions quickly, is identified. A taxonomy of flight safety research is presented in tabular form, along with a list of recent projects. Ways are discussed in which flight safety research might be correlated among the many technical interests and disciplines of workers, with careful consideration of the taxonomy. Steps now being taken in a planned experimental approach toward improvement of information transfer in the cockpit, using a central primary flight control status and command readout, are described. P.A.B.

N69-24235# Royal Aircraft Establishment, Farnborough (England).

SOME THOUGHTS ON V/STOL DISPLAYS AND APPROACH TECHNIQUES

R. W. Millward *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 2 p (See N69-24230 12-02)

Avail: CFSTI

The task of bringing a V/STOL aircraft from a fully wingborne flight regime in the vicinity of a landing site, to a position from which the pilot can make a visual vertical or short landing, is considered. The pilot's requirements are identified, with regard to situation information, stability and control, guidance, and techniques. It is concluded that, for V/STOL approach tasks in IFR conditions, operational minima of 200 ft and 1/2 N.M. should be sought. High quality situation information is required, including plan position information relative to the landing site; director displays may be redundant when adequate situation information is provided. The stepped approach technique seems to offer the best level of pilot confidence and performance. It is stated that stability and control characteristics of V/STOL aircraft should be as good as those of conventional low speed aircraft; attitude autostabilization should be used, if necessary, to produce the required handling characteristics. P.A.B.

N69-24236# Technische Hochschule Munchen (West Germany).

INVESTIGATIONS OF THE TERM "REMNANT SPECTRUM" OF THE HUMAN CONTROL OUTPUT FUNCTION

U. Miller and R. Seifert *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 4 p refs (See N69-24230 12-02)

Avail: CFSTI

Criteria for assessing man's performance in a given system and methods for defining the task load and system difficulty without applying known descriptive models are investigated. The experimental arrangement for studying manual tracking control systems while applying mathematically defined varied input forcing functions is described. Results and conclusions for first and second order system experiments are summarized. P.A.B.

N69-24237# Deutsche Versuchsanstalt fur Luft-und Raumfahrt, Porz (West Germany).

TEST RESULTS WITH NEW ANALOG DISPLAYS FOR ALL-WEATHER LANDINGS

V. Wilckens and W. Schattenmann *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 6 p (See N69-24230 12-02)

Avail: CFSTI

Two situation analog displays were evaluated on a fixed base simulator, programmed for a small propeller aircraft and a jetfighter and compared with common versions of instrument landing

system information. The results exhibited small errors in approach path tracking and flare control. Although of the pure situation type, the displays allowed easy control and high success rates. Author

N69-24238# Federal Aviation Administration, Washington, D. C. Aircraft Development Service.
IMPROVED DISPLAYS AND STABILIZATION IN GENERAL AVIATION AIRCRAFT
Collin G. Simpson *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 2 p (See N69-24230 12-02)
Avail: CFSTI

A project is described which examined the use of improved displays and automatic flight control as methods of easing the cockpit workload of a single pilot flying on instruments. The data indicate an appreciable pilot workload reduction when a pictorial navigation display is employed in conjunction with normal instruments for flight under instrument conditions, and an almost equal additional amount of workload reduction if the aircraft is stabilized and controlled by means of an autopilot. Such an improved cockpit environment also appears to facilitate instrument training. P.A.B.

N69-24239# Litton Systems, Inc., Woodland Hills, Calif. Guidance and Control Systems Div.
THE COCKPIT AS A "BRAIN CENTER" TRADEOFF
Raymond E. Bernberg *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 2 p (See N69-24230 12-02)
Avail: CFSTI

Some of the advances being made in establishing a new man/machine interface in the aircraft system are explored, with the emphasis on the success of the mission. Digital flight control, digital monitoring of avionics, and automation enabling target detection are discussed. The need for providing additional automation–computer system capability is pointed out. Other "brains" are needed than just the usual digital computer, to achieve the optimal man/machine relationship, and the cockpit becomes the focus of system actuation, the brain center tradeoff area. The brains which initiate the operating sequences and modes may include the pilot/copilot, the computer system, and adjunctive system elements. P.A.B.

N69-24240# British Aircraft Corp., Preston (England).
CREW WORK-LOAD SHARING ASSESSMENT IN ALL-WEATHER, LOW-LEVEL STRIKE AIRCRAFT
Alan F. Daniels *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 3 p (See N69-24230 12-02)
Avail: CFSTI

A program is discussed which investigated optimum utilization of available crew work space in cockpit design, optimum workload division between the members of a two man crew, and the upper limit of workload which can be imposed. The study was conducted on a simple and inexpensive wooden local cockpit mockup, pictorial only in respect of displays and system controls and equipped with a function intercommunication system paralleled with a tape recorder. A time lapse camera was fitted covering the cockpits in which the navigation/attack system represented an analogue system currently being fitted to an aircraft. The basic elements of the navigation/attack system and other aircraft systems represented in the layout are summarized. The areas of detailed operation in which handling and crew notes were prepared are listed, and it is noted that such preparation during the early feasibility studies of an aircraft greatly helps in integrating all aircraft subsystems. P.A.B.

N69-24241# National Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
A QUANTITATIVE METHOD TO EVALUATE THE FAIL-SAFETY ASPECTS OF FLIGHT INSTRUMENTATION WIRING PATTERNS
J. M. H. van Vlaenderen *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 8 p (See N69-24230 12-02)
Avail: CFSTI

The investigation covered the electrical instruments; the components normally involved in interconnection and most vulnerable to failures are listed. The purpose of the study was to compare the relative merits of various systems in use and to develop optimum configurations with regard to fail-safety. Objective numerical scoring methods were used to investigate failure detection probabilities and information loss after a failure. A general classification of layouts, methods for evaluating existing systems, basic patterns obtained, optimum systems, compiled scoring results, and study conclusions are summarized. P.A.B.

N69-24242# Boeing Co., Seattle, Wash.
A DEVELOPMENT IN COCKPIT GEOMETRY EVALUATION
Leo F. Hickey, Wayne E. Springer, and Francis L. Cundari (ONR, Washington, D. C.) *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 6 p refs (See N69-24230 12-02)
(CONTRACT N00014-68-C-0289)
Avail: CFSTI

A research effort to develop a modeling technique that capitalizes on the large capacity and high speed of electronic digital computers is discussed. The model will dynamically simulate any human form, cockpit geometry, and flight crew movement necessary to operate the cockpit being evaluated. The resulting computer program will permit the designer to use effectively the vast quantity of anthropological and ergometric human data to help optimize crewstation design. The research plan for the six phase study is summarized. P.A.B.

N69-24244# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Anthropology Branch.
GROUND AREAS VISIBLE FROM THE AIRCRAFT COCKPIT EYE POSITION: A METHOD OF EVALUATION
K. W. Kennedy *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 3 p (See N69-24230 12-02)
Avail: CFSTI

A program to develop a realistic and objective method for comparing aircraft in terms of the ground areas visible from their cockpits is summarized. The method consists of calculating the area of the earth's surface visible from the pilot's eye position, within a radius of 3000 feet and of 18,000 feet. The ground area visible, expressed as a percentage, may be regarded as an index of the visibility from the cockpit. Author

N69-24246# Honeywell, Inc., Minneapolis, Minn.
VTOL DISPLAYS AND CONTROLS FOR ALL-WEATHER FLIGHT
Francis L. Cundari (ONR, Washington, D. C.), Robert M. Nicholson, Bernard S. Gurman (ECOM, Ft. Monmouth, N. J.), and Charles A. Baker (DOT, Washington, D. C.) *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 6 p (See N69-24230 12-02)
Avail: CFSTI

A program is discussed which attempted the analytic definition and laboratory demonstration of a representative system providing a capability for all-weather coordinated flight of helicopter formations in military applications. The study consisted of a series of iterative analyses and real time man-in-the-loop simulations designed to synthesize an optimal system concept, in terms of pilot information processing and control capabilities, for the desired mission. The significant findings of the investigation are summarized. P.A.B.

N69-24247# Royal Aircraft Establishment, Bedford (England).
HEAD-UP DISPLAY OF APPROACH INFORMATION
D. Johnson and R. W. Jones *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 5 p (See N69-24230 12-02)
Avail: CFSTI

The NAD display, an integrated display designed specifically to present to the pilot all essential flight information for the approach using the minimum number of symbols, is described. The manner in which position information is derived and presented is discussed, along with the satisfaction of the flight director control laws. P.A.B.

N69-24250# National Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
HEAD-UP DISPLAY SYMBOLOGY
F. E. Douwes Dekker *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 5 p (See N69-24230 12-02)
Avail: CFSTI

Manual blind landings, comprising head-down or head-up director displays and different types of automatic assistance, have been demonstrated to be equal in quality to that of automatic landings, provided that appropriate information is presented to the pilot. Head-up displays are discussed in terms of these manual blind landings, instrument-to-visual transition, integration, flight path vector, display symbology, and application. P.A.B.

N69-24252# Bell Helicopter Co., Fort Worth, Tex. Human Factors Div.
ADVANCES IN V/STOL COCKPIT INFORMATION
Dora Dougherty *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 2 p (See N69-24230 12-02)
Avail: CFSTI

New information which is becoming available can expand the pilot's ability to see in the dark and through obstructions to visibility. The new displays might be dichotomized into directly sensed imaging systems and computer-processed information displays. Flight testing of a new helicopter radar display system, with the antenna embedded in a rotor blade, and of computerized displays, such as the helicopter application of the pictorial contact-analog forward looking displays, is discussed. Problems confronting cockpit designers in the display of the new information must be met with new techniques. Possible solutions to cockpit and instrument panel crowding are proposed, including (1) a multimode display, permitting switching from one presentation to another; (2) a head-up display (HUD) which presents information on a transparent surface with see-through capabilities; and (3) a HUD modification which is a head-mounted or helmet-mounted display. P.A.B.

N69-24253# Human Factors Research, Inc., Goleta, Calif.
THE DISPLAY OF AERONAUTICAL CHARTS
James J. McGrath *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 2 p (See N69-24230 12-02)
(Contract Nonr-4218(00))
Avail: CFSTI

Current capabilities in the display of aeronautical charts in the cockpit environment are summarized. The main advantages and disadvantages of the three main types of systems being developed, direct view displays, projection displays, and kinescopic displays, are reviewed. The different displays are compared, and a guide for choosing among the alternative modes is suggested. P.A.B.

N69-24255# Royal Aircraft Establishment, Farnborough (England).
THE ELECTRONIC DISPLAY OF PRIMARY FLIGHT DATA
David J. Walters *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 refs (See N69-24230 12-02)
Avail: CFSTI

Engine rating, control, and operation, engine instrumentation, and emergency controls for combat/strike and transport aircraft are discussed. Further development is recommended for reliable automatic controls, computerized engine instrument displays, auto-monitoring, and maintenance recorders, in order to reduce the pilot's workload and enable him to perform his operational task more effectively. P.A.B.

N69-24279*# General Motors Corp., Indianapolis, Ind. Allison Div.
QUIET ENGINE DEFINITION PROGRAM Final Report
19 Sep. 1968 213 p refs
(Contract NAS3-10496)
(NASA-CR-72458; FDR-5996) Avail: CFSTI CSCL 01C

The quiet engine definition program consisted of a study of the design characteristics and noise production of engines in the bypass ratio range of 3 to 8. A preliminary design was made for an engine having a bypass ratio of 5.5. This engine is rated at 4900-lb (21.8-kN) cruise thrust at 35,000 ft (10.7 km) at Mach 0.82. The specific fuel consumption is 0.627 $lb_f/hr/lb_t$ (0.0177 g/N-sec). The engine weight is 4780 lb (2168 kg), the fan tip diameter is 74 in. (1.88 m), and the length is 153 in. (3.89 m). The predicted four-engine aircraft noise levels during takeoff and approach are 105.6 and 104.1 PNdB, respectively. Author

N69-24284# Lockheed-Georgia Co., Marietta.
BIBLIOGRAPHY OF CONVENTIONAL LARGE TRANSPORT AIRCRAFT HANDLING QUALITIES AT SUPERSONIC SPEEDS
A. J. Kuchinka 1 Jan. 1969 49 p refs
(ER-10045) Avail: Issuing Activity

A bibliography is presented basically restricted to conventional subsonic ($M < 1.0$), large transport aircraft handling qualities. A few reports on STOL, supersonic, turbulence, etc., were included to round out the information content and provide a starting place for anyone who desired more information concerning these somewhat related subjects. The sections contained in this bibliography are: (1) bibliographies, (2) conference proceedings, (3) general interest reports, (4) lateral-directional pilot opinions, (5) longitudinal pilot opinions, (6) longitudinal and lateral-directional pilot opinions, (7) specifications, and (8) unreviewed reports. Author

N69-24290# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
GENERAL AVIATION COCKPIT DISPLAY AND CONTROL SIMULATION Final Report
Robert J. Ontiveros Oct. 1968 167 p refs
(AD-680054; NA-68-48; DS-68-17) Avail: CFSTI CSCL 5/9

An experiment was conducted to evaluate, by use of a general aviation simulator and airplane, typical versus experimental concepts of general aviation cockpit environments in an effort to reduce pilot workload and training time to operate an airplane in todays IFR environment and to meet the flight skills required for the instrument rating flight test. Phase I of the experiment examined the flight performance of a group of noninstrument-rated pilot subjects utilizing a cockpit environment typical of aircraft used for single engine instrument flight training. Phase II of the experiment examined the instrument flight performance of a similar group of pilots. Flight training was accomplished in an experimental cockpit environment consisting of improved cockpit displays, controls and

instruments to provide maximum assistance to the pilot. Project results indicated a reduced pilot workload and training time to operate an aircraft in an IFR environment. An experimental flight training syllabus was utilized with both pilot groups. Phase III of the experiment examined the flight performance of the Phase II group in a conventional cockpit environment. The report also describes pilot performance and problem areas encountered during training and check flights in both the typical and experimental cockpit environments of the simulator and airplane. Author (TAB)

N69-24393# Honeywell, Inc., Minneapolis, Minn. Aerospace Div.

FABRICATION AND FUNCTIONAL TEST OF FLIGHTWORTHY FLUIDIC YAW DAMPER Final Report

Walter M. Posingies Oct. 1968 66 p

(Contract DAAJ02-67-C-0056)

(AD-680275; USAAVLABS-TR-68-62; Rept-20885-FRI) Avail: CFSTI CSCL 1/3

The objective of the program was to design, fabricate, and perform acceptance tests on a flightworthy fluidic yaw damper system and to provide support during flight evaluation of the system. Control-system characteristics were optimized for the UH-1 series helicopters. This program incorporated significant improvements in the areas of component design, high-pass circuit simplification, noise reduction, and fabrication techniques. Temperature compensation studies illustrated a technique for maintaining a relatively constant rate-sensor scale factor over a wide range of fluid temperatures. Flightworthiness testing demonstrated that the system provided the required transfer function and was suitable for flight test. The flight test (not reported in this document) confirmed that the system was suitable for the helicopter environments and that it would increase the vehicle directional damping ratio from 0.3 to 0.6. Post-flight tests in the laboratory determined the bench performance of the system under several special conditions to which the system had been adjusted during the flight test. The program demonstrated that fluidic systems operating with hydraulic fluid can accurately provide simple control functions. Consistent and trouble-free performance obtained during this development indicates that fluidic systems should be considered for applications which require similar functions. Author (TAB)

N69-24394# Bolkow Entwicklungen K. G., Munich (West Germany).

INSTABILITY OF THE ROTOR-NACELLE-WING SYSTEM DUE TO AERODYNAMIC FORCES ON TILTING-ROTOR AIRCRAFT [DURCH LUFTKRAEFTE BEDINGTE IN STABILITAET DES ROTOR-GONDEL-FLUEGEL-SYSTEMS VON KIPPROTORFLUGZEUGEN]

K. Heinig 21 Nov. 1968 25 p refs In GERMAN Submitted for publication

(DF-91-O; A-63) Avail: CFSTI

The physics of rotor whirl flutter are briefly described and then applied to examine the effects of several parameters on the stability of the rotor-nacelle-wing configuration of a tilting-rotor aircraft. The frequency ranges of hinged as well as fixed rotors are considered. The parametric study shows that rotor whirl flutter at frequencies characteristic of fixed rotor blades can be controlled with relatively low blade rigidity. Transl. by K.W.

N69-24402# Radio Corp. of America, Moorestown, N. J.

TECHNOLOGY FOR THE TACTICAL ENVIRONMENT

David Shore *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 2 p (See N69-24401 12-08)

Avail: CFSTI

Trends in the present operational environment are described, and a model systems concept for post-1975 tactical air command and control is developed. The more significant factors in the present tactical environment are identified as: (1) vulnerability of fixed installations to attack; (2) day-night, all weather operations; (3) effectiveness of air defense; and (4) sanctuaries. A.C.R.

N69-24507# Brooks and Perkins, Inc., Detroit, Mich.

DESIGN, DEVELOPMENT, FABRICATION, AND TESTING OF SMALL AND LARGE LOAD-BEARING PALLETS FOR THE CH-54 "FLYING CRANE" HELICOPTER Final Report

M. Krolikiewicz Ft. Eustis, Va. Army Aviation Mater. Labs. Oct. 1968 45 p refs

(Contract DAAJ02-67-C-0052)

(AD-680283; USAAVLABS-TR-68-71) Avail: CFSTI CSCL 1/3

The CH-54A helicopters load-bearing capability was limited to loads which had the structural integrity to be suspended by slings or could be carried in pods suspended underneath the helicopter. The operation of the helicopter with these loads was limited to fair weather. To increase the load-bearing capability of the helicopter in fair weather and to permit operation in inclement weather, small and large load-bearing pallets which can be suspended from the helicopter were designed and developed. The results of tests performed indicated that the use of these load-bearing pallets enables the helicopter to carry loads which are bulky and/or do not possess the structural integrity to be suspended by slings from the helicopter. Author (TAB)

N69-24552# Bolkow Entwicklungen K. G., Munich (West Germany).

TILTING-ROOTOR AIRCRAFT WITH FIXED ROTOR BLADES: "SYSTEM BOLKOW" [KIPPROTORFLUGZEUGE MIT GELENKLOSEM ROTOR "SYSTEM BOLKOW"]

18 Nov. 1968 40 p refs In GERMAN Submitted for publication

(DF-89-O; A-62) Avail: CFSTI

Design details for wings and rotors are presented for a tilting-rotor transport aircraft with a net lifting capacity of 5.6 t and an operational range of 90 km. The use of rigid rotors is considered. Control requirements in hover flight, the aerodynamics of the rotor-wing system, and the high stress on the blades due to their use for aircraft control are examined. Blade and rotor head design considerations include the geometry of the blade neck, blade construction, and use of unconventional materials. Transl. by K.W.

N69-24553# Defense Documentation Center, Alexandria, Va.

HELICOPTER ENGINES AND ROTORS, VOLUME 1 Report Bibliography, Jan. 1960-Jul. 1968

Nov. 1968 247 p refs

(AD-680200; DDC-TAS-69-57) Avail: CFSTI CSCL 1/3

The annotated bibliography is a selection of unclassified and unlimited distribution references on helicopter engines and rotors. Engine references describe reports on Turbojet and Reciprocating Engines, Engine Monitoring and Control Systems, Regenerators, Diffusers, Fuels, Lubricants, Environmental Tests, Ingestion, and Engine Failure. Helicopter Transmissions, Planetary Gearing, Harmonic Drives, and Supercritical Shafts are included. Rotor abstracts include descriptions of reports on Hubs, Blades, Materials, Hovering, Transitional Flight, Wake Characteristics, Flight tests, Wind Tunnel Tests, Environmental Tests, and Rotor Noise. Tandem Rotors, Heavy-Lift Rotors, Hot Cycle Rotors, Rigid Rotors, Jet-Flap Rotors, Shrouded Rotors, and Tail Rotors are represented. Indexes of Corporate Author-Monitoring Agency, Subject, Personal Author, Contract Number, Report Number, and AD-Number are included. Author (TAB)

N69-24685# Ryan Aeronautical Co., San Diego.
INSPECTIONS, REPAIRS AND MODIFICATIONS, AND FLIGHT TEST OF THE FLEXIBLE-WING MANNED TEST VEHICLE XV-8A Final Report
James F. Irvine Jun. 1968 102 p refs
(Contracts DA-44-177-AMC-402(T); DA-44-177-AMC-359(T); DA-44-177-AMC-395(T); ARPA Order 294)
(AD-680316; Rept-16480-1A; USAAVLABS-TR-68-30) Avail: CFSTI CSCL 1/3

The report provides engineering data, including results of teardown inspection, flight tests, and evaluation of flight characteristics, for two manned flexible-wing aerial utility vehicles XV-8A. Author (TAB)

N69-24602# Defense Documentation Center, Alexandria, Va.
VERTICAL TAKE-OFF PLANES, VOLUME 1 Report Bibliography, 1954-Jun. 1968
Nov. 1968 123 p refs
(AD-683500; DDC-TAS-68-64) Avail: CFSTI CSCL 1/3

The volume contains 93 annotated references which were selected from unclassified and unlimited material in the DDC collection, and which cover a period from 1954 to June 1968. The references relate to design, configurations, testing, handling qualities, performance, stability, and control evaluation and analysis of VTOL aircraft. TAB

N69-24677# George Washington Univ., Alexandria, Va. Human Resources Research Office.
EVALUATION OF SYNTHETIC INSTRUMENT FLIGHT TRAINING IN THE OFFICER/WARRANT OFFICER ROTARY WING AVIATOR COURSE
Robert N. Isley, Paul W. Caro, Jr., and Oran B. Jolley Nov. 1968 49 p refs
(Contract DA-44-188-ARO-2)
(AD-680586; HUMRRO-TR-68-14) Avail: CFSTI CSCL 5/9

The objective was to determine the training value of synthetic instrument flight training given in the Tactical Instrument Phase of the Army's Officer/Warrant Officer Rotary Wing Aviator Course. Synthetic training in that course is administered in a modified fixed wing instrument training device. One group of trainees received the standard 20-hour synthetic instrument flight training program, a second group received 10 hours, and a third group received no synthetic training. The synthetic training given in the modified fixed wing training device did not increase trainee helicopter instrument flight proficiency in terms of aircraft control and procedural skills. In addition, there were no significant differences among the three groups in attrition, instructor-assigned daily grades, amount of flight instructional time required to complete the phase, and final checkride grades. Author (TAB)

N69-24707# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
NEW CONSIDERATIONS OF THE FLUCTUATING FLOW FIELD IN PROPELLER THEORY Final Report, Jun.-Nov. 1968
John C. Erickson, Jr. Nov. 1968 8 p refs
(Contract DAHC04-68-C-0039)
(AD-680232; CAL-88-2670-S-1; AROD-7989-1-E) Avail: CFSTI CSCL 1/3

Research on the propeller flow field associated with typical V/STOL aircraft operating conditions is summarized briefly. Axial cruise flight and static operation are treated with emphasis on the effects of blade circulation distribution shape and the differences between the mean and fluctuating flow fields. Author (TAB)

N69-24720# Kaman Aircraft Corp., Bloomfield, Conn.
EVALUATION OF HELICOPTER FLIGHT SPECTRUM DATA Final Report
John D. Porterfield and Paul F. Maloney Ft. Eustis, Va. Army Aviation Materiel Labs. Oct. 1968 119 p refs
(Contract DAAJ02-67-C-0055)
(AD-680280; R-739; USAAVLABS-TR-68-66) Avail: CFSTI CSCL 1/3

The report evaluates helicopter flight spectrum data previously recorded and published in other reports, with emphasis on the UH-1B utility, CH-47A cargo, and CH-54A load lifting helicopters as used in the Army environment. A limited statistical analysis of the data is presented for those parameters for which sufficient data were available. The report includes a comparison of the flight-measured data with the spectrum appearing in Appendix A of Civil Aeronautics Manual 6, and with the assumed fatigue substantiation spectrum, where this was available. Discussion and evaluation of the spectrum variations that do occur, particularly as they might affect component fatigue lives, are also included. A method for deriving an operational spectrum for the classes of helicopters evaluated is presented along with discussion of some of the considerations and judgment which play a part in the establishment of a rational, conservative spectrum for the critical components. Author (TAB)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N69-23356*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A PARAMETRIC ANALYSIS OF SURFACE TEMPERATURES OF PARABOLOIDAL SOLAR CONCENTRATORS IN SPACE
Robert J. Platt, Jr. Washington Apr. 1969 68 p refs
(NASA-TN-D-5144) Avail: CFSTI CSCL 10B

A parametric analysis was made of the surface temperatures of a paraboloidal mirror in space and aimed at the sun. The problem is simplified by the assumption of steady-state conditions, the paraboloidal mirror (solar concentrator) being located directly between the earth and the sun. Surface temperatures are plotted for a range of the important parameters for altitudes up to 35,000 kilometers. Additional temperature plots are presented for the case of a solar concentrator approaching the sun. The results indicate that at an irradiance of one solar constant, a concentrator of very low thermal conductance may experience a front surface temperature of 600°K in space, unless a front surface coating is used to increase the emittance. The temperature difference between the front and rear surfaces, which causes thermal distortion of the mirror, may be greatly reduced by proper selection of thermal control surfaces if the concentrator is near the earth. At irradiances of many solar constants, as in the case of a concentrator used with a solar probe, metal construction and high emittance coatings appear to be needed to reduce the front surface temperature and to minimize thermal distortion. Author

N69-23368*# Hayes International Corp., Huntsville, Ala. Missile and Space Support Div.
ELECTRICAL CONTROL PACKAGE FOR BRAYTON POWER CONVERSION SYSTEM Final Report

Jan. 1969 44 p
(Contract NAS3-11784)
(NASA-CR-72479) Avail: CFSTI CSCL 10B

The Brayton power conversion system (PCS) has applicability for solar, radioisotopes, and nuclear space power systems in the net output power range of 2.25 to 10.5 KWe at 1200 hertz. The Brayton PCS is designed to operate unattended in space for five years. The Brayton rotating unit (BRU) for the Brayton PCS is a constant speed single shaft unit. The 1200 hertz alternator section of the shaft is supported by gas bearings with a compressor overhung on one end of the single shaft and a turbine overhung on the other end. A mixture of gases is used as the working fluid to convert the heat energy input into electrical energy as the output of the alternator. The electrical control package contains the circuitry necessary to maintain the alternator output within finite limits of voltage and frequency and also functions as the power distribution center for the alternator output power. The circuitry consists of the alternator series field power supply, the voltage regulator for controlling the shunt field supply, and the three channel speed control. Author

N69-23369*# Clevite Corp., Cleveland, Ohio.
CdS SOLAR CELL DEVELOPMENT Final Report
F. A. Shirland, W. K. Bower, W. F. Dunn, and J. B. Green 14 Mar. 1969 85 p refs
(Contract NAS3-9434)
(NASA-CR-72534) Avail: CFSTI CSCL 10B

The major objectives of this second year of the program were to continue the characterization of the stability of the plastic substrate CdS thin film solar cell and to isolate and eliminate the causes of instability whenever possible. Toward that end, a standard process laboratory fabrication line was operated throughout the entire 2 year period to yield a total of 100 acceptable quality cells each month. Of these, 75 cells each month were tested and sent to the contract monitor. The remaining 25 cells were retained and placed on various dry and wet shelf storage tests, high temperature vacuum storage tests, and various temperature cycling and continuous use tests. Those cells which showed appreciable loss of output on these various tests were removed and subjected to detailed failure analyses in an effort to determine the causes of failure. Subsequently, various constructional and fabrication process variations were evaluated as possible ways around the cell weaknesses as disclosed by the various tests and analyses. Author

N69-23384*# Thermo Electron Corp., Waltham, Mass.
RESEARCH IN THERMIONIC CONVERSION Final Report, Sep. 1966–Sep. 1967
D. Lieb et al Sep. 1967 248 p refs
(Contract NAS7-508)
(NAS-CR-100658; TE-4072-49-68) Avail: CFSTI CSCL 10B

The results of a detailed theoretical analysis of the plasma properties of thermionic converters are presented, with particular emphasis on the influence of electron thermal conductivity and ionization rate on spatial distributions. Parametric data obtained from variable spacing converters, including those with electroetched rhenium emitters and with single crystal tungsten emitters, are given. The effect of oxygen on converter performance, studied in a variable spacing research converter, is discussed, along with data on the possibility of using cesium oxides as a source of both cesium and oxygen. The behavior of molybdenum trioxide as an oxygen additive is investigated, with results indicating that it does release oxygen although not in the amounts expected. Studies on the use of electropositive additives to improve the performance of low-pressure cesium converters indicate that the emitter work function is reduced, but that improvement in converter performance is doubtful. P.A.B.

N69-23412*# Esso Research and Engineering Co., Linden, N. J. Government Research Lab.
STUDY OF MULTIPLE RESERVE ELECTROCHEMICAL POWER SOURCE Final Report, 11 Jun.–15 Dec. 1968
George Ciprios Jan. 1969 128 p refs
(Contract NAS7-673)
(NASA-CR-100857; GR-1-1MPS-69) Avail: CFSTI CSCL 10B

Neat hydrazine and 98 wt. % hydrogen peroxide are used as storable reactants. Appropriate high temperature reactors, containing propellant decomposition catalysts, are used to generate hydrogen and oxygen feed gases for the fuel cell. Allis–Chalmers fuel cell modules were selected for the centerline design on the basis of low specific weight and demonstrated bootstrap start-up capability. Catalysts with adequate activity are available to permit instantaneous reactor start-up with either reactant at +5°C, the design dead-storage temperature. Only small amounts of catalyst were needed for complete reactant decomposition, but added amounts of ammonia decomposition catalyst are required to increase hydrogen yield. A palladium diffuser is used to recover ultrapure hydrogen, permitting efficient fuel cell operation. Overall system thermal control in near-sun and deep-space environments is a critical problem requiring further study. Integrated power plant specific energies ranged from 122 to 292 WH/lb for mission on-load times of 100 or 1000 hours and power levels of 200 to 5000 watts. Author

N69-23436*# Globe-Union, Inc., El Monte, Calif. Centralab Semiconductor Div.
STUDY OF LITHIUM DOPED SOLAR CELLS Quarterly Report
Peter A. Iles 15 Jan. 1969 11 p Prepared for JPL
(Contract NAS7-100; JPL-952250)
(NASA-CR-100676; Rept-9; QR-3) Avail: CFSTI CSCL 10B

Electrical differences observed for the different forms of silicon were confirmed and analysed. One cell shipment of 120 cells was made; analysis of these cells is included. Author

N69-23443*# Globe-Union, Inc., El Monte, Calif. Centralab Semiconductor Div.
STUDY OF LITHIUM DOPED SOLAR CELLS Quarterly Report
Peter A. Iles 15 Nov. 1968 23 p Prepared for JPL
(Contracts NAS7-100; JPL-952250)
(NASA-CR-100677; Rept-7; QR-2) Avail: CFSTI CSCL 10B

The increased understanding gained of the effects of various lithium diffusion schedules on cell behavior is reported. Included is a summary of one shipment of 60 cells delivered to JPL for testing. Author

N69-23572 North Carolina State Univ., Raleigh.
A STUDY OF THE EFFECTS OF THE SURFACE POTENTIAL ON THE SURFACE RECOMBINATION VELOCITY AT A SILICON–SILICON OXIDE INTERFACE
Francis Joseph Morris (Ph.D. Thesis) 1968 171 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-14667

MOS field effect solar cells were fabricated on p/n thermally oxidized epitaxial wafers. A mathematical model was developed for the solar cell which included the effects of recombination at the surface, as well as the recombination and generation in the surface space charge region. By measuring the short circuit current and the MOS capacitance as a function of gate bias, the surface recombination velocity at the oxide–silicon interface, as a function

of surface potential, could be determined. It was possible to vary the surface recombination velocity from a maximum value of 5×10^4 cm/sec to a value near zero by varying the surface potential. The ratio of the hole to electron capture probabilities was found to be 4.4. The capture cross sections were estimated to be in the 10^{-17} to 10^{-19} cm^2 range. Dissert. Abstr.

N69-23600# Sandia Corp., Albuquerque, N. Mex. Space Power Research Div.

A COMPUTER TECHNIQUE TO DETERMINE THE SEEBECK COEFFICIENT OF THERMOELECTRIC MATERIALS IN A CHANGING TEMPERATURE GRADIENT

Richard M. White Oct. 1968 57 p refs Sponsored by AEC
(SC-RR-68-636) Avail: AEC Depository Libraries

A computer technique is presented which determines the Seebeck coefficient of thermoelectric materials in a changing temperature gradient. A mathematical description of the technique is presented, and typical test data are analyzed. The limitations of the technique and its range of application are determined. Author (NSA)

N69-23643*# National Aeronautics and Space Administration. Washington, D. C.

INDUCTION HEATING ADVANCES: APPLICATIONS TO 5800°F

A. F. Leatherman and D. E. Stutz 1969 46 p refs
(NASA-SP-5071) Avail: SOD $0.30 CSCL 13A

Induction furnace design and basic heating principles are discussed. Vacuum reaction, vacuum brazing, and protective atmosphere furnaces are described, and radiant heat shielding designs are included. Theoretical considerations are given to induced currents and skin effects, operating frequency, heating coils, and power requirements. Various equipment arrangements are illustrated, and characteristics of components are given. Some of the more important advantages of induction heating are identified as no contact between work load and heat source, very high temperature capability, rapid heating, simplified control of processing, high efficiency, production capabilities, localization of heat, choice of vacuum or atmospheres, and cooler and cleaner working conditions. N.E.N.

N69-23780*# Allis-Chalmers Mfg. Co., Milwaukee, Wis. Advanced Electrochemical Products Div.

SUMMARY REPORT FOR PHASE 2: AAP FUEL CELL PROGRAM

[1968] 158 p *Its* Tech. Doc. No. 692
(Contracts NAS9-5834; NAS9-6737)
(NASA-CR-99618) Avail: CFSTI CSCL 10B

The basic fuel cell design demonstrated a capability of achieving the 1500 hour objectives. Preliminary flight packaging and addition of support components were also accomplished. An engineering module was tested for 2800 hours within performance limits, achieving the secondary objective of advancing the design to a 2500 hour capacity. Two modules were assembled, acceptance tested, and engineering evaluation tested. All components underwent design verification testing. A final packaging arrangement was achieved, including the addition of new components which provide a complete flight configuration. A quality assurance system was developed and implemented. Author

N69-23783*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CADMIUM SULFIDE THIN-FILM SOLAR CELL REVIEW

A. F. Forestieri ed., A. E. Spakowski ed., and H. W. Brandhorst, Jr. ed. June 1968 147 p refs Presented at a NASA rev. meeting, Cleveland, 11–12 Jun. 1968
(NASA-TM-X-52579) Avail: CFSTI CSCL 10B

In September 1967, the results of the program on CdS were reviewed. The programs were then redirected to attempt to uncover the cause or causes for the erratic behavior observed in cadmium sulfide thin-film solar cells. Some of the phenomena observed were: the cells degraded and sometimes recovered; there was a large amount of scatter in the data; cells were not reproducible. The most likely cause for these observations was attributed to mechanical faults in the cells, and the most likely suspect was the grid attachment. The redirected program plan included: maintain a standard cell design for the pilot line production so as not to introduce new variables by design changes; improve cell reproducibility by improved quality control and standardized fabrication techniques; check and improve measurement techniques; design experiments and special cells to determine the effect of grid attachment; attempt to determine the electronic model for electrical behavior of the cell; use new diagnostic techniques to characterize the cell and search for degradation causes. Author

N69-23848# AEG-Telefunken, Hamburg (West Germany).

A STUDY ON THE DEVELOPMENT OF IMPROVED INTERCONNECTION TECHNIQUES FOR SILICON SOLAR CELL ARRAYS Quarterly Report, 1 Feb. – 30 Apr. 1968

H. Fischer, I. Gehrke, R. Gereth, W. Pschunder, and W. Schoeberl Paris ESRO May 1968 48 p refs
(Contract ESTEC-459/67AA)
(ESRO-CR-2; QR-1) Avail: CFSTI

Improved interconnection techniques for silicon solar cells are investigated. Ultrasonic welding, thermocompression bonding, or resistance welding should replace soft solder interconnection procedures. The feasibility of the solderless bonding methods is evaluated. Existing bonding facilities are modified to fulfill the requirements for achieving large area, low resistance contacts. Measurements of the tearing strength exhibit a linear dependence on the thickness of gold contact stripes. The electrical characteristics of TiAg-coated solar cells do not deteriorate after ultrasonic- and thermocompression bonding. A reduction of the AMO conversion efficiency is noticed after resistance welding. A new contact metallurgy for Si solar cells is examined. Design considerations concerning series resistance, contact resistance, and contact adherence are discussed. Measurements of the forward characteristic of non-illuminated solar cells are employed to study the influence of different contact materials on the pn-junction behavior. The results of these investigations suggest that contacts for solar cells to replace TiAg-contacts should be combinations of Ag as conducting material and Cr, Mo, or Ta as adhesive layer. Author (ESRO)

N69-24267*# Hoffman Electronics Corp., El Monte, Calif.

METHOD FOR PRODUCING A SOLAR CELL HAVING AN INTEGRAL PROTECTIVE COVERING

Peter A. Iles, inventor (to NASA) Issued 8 Apr. 1969 (Filed 26 Oct. 1966) 5 p Cl. 136-89
(NASA-Case-XGS-4531; US-Patent-3,437,527; US-Patent-Appl.-SN-590141) Avail: US Patent Office CSCL 10B

The method comprises the inclusion of a thin dielectric layer between the diffused surface of the semiconductor and the evaporated metal contacts. By carefully controlling the thickness of the metal and the dielectric layers it is possible during the final glass fusion step to allow the metal contacts to penetrate the dielectric layer and make ohmic contact with the diffused layer of the semiconductor, while further penetration of the diffused layer is retarded. Official Gazette of the U.S. Patent Office

N69-24271# AEG-Telefunken, Hamburg (West Germany).
A STUDY ON THE DEVELOPMENT OF IMPROVED INTERCONNECTION TECHNIQUES FOR SILICON SOLAR CELL ARRAYS Quarterly Report, 1 May – 31 Jul. 1968
H. Fischer, J. Gehrke, R. Gereth, U. Himstedt, W. Pschunder et al. Paris ESRO Aug. 1968 81 p refs
(Contract ESTEC-459/67AA)
(ESRO-CR-4; QR-2) Avail: CFSTI

Emphasis is made on the long-term behaviour of various contact systems. The stability of the contacts is tested after storage in 100% relative humidity at 90°C. Adherence of the contacts is determined by a tape test. Measurements of series resistance combined with measurements of maximum power output of solar cells under AMO illumination are employed to study the influence of contact corrosion on the solar cell behaviour. No two-component contact system, consisting of an adhesive layer like Ti, Cr, Mo, Ta, and a conductive layer of Ag, survives the storage test. Electrochemically passive contacts like CrAl, CrAu are stable against humidity but applied to solar cells they yield considerably less efficient and less temperature-resistant cells. Preliminary results with electrochemically passivated TiAg contacts, accomplished by covering the Ti layer with an extremely thin film of Pd, indicate that such systems can successfully replace solder-dipped TiAg contacts. The investigations to optimize the welding procedure have been done with new specific machines, of which the welding parameters may exactly be adjusted. Most of the welding trials had been performed with standard TiAg contacted, solderless Si-solar cells. Two welding techniques have been investigated: resistance welding (RC) and ultrasonic welding (US). The first criterion is the adherence of the bonds. This can be achieved by US welding with several materials, if one component is of Al or Al-alloy. But adherence by RC welding cannot be achieved with Al (because of an Al_2O_3-layer) but can be achieved with nearly all other metals tested. Electrical performance alternation, which is the second criterion of a feasible welding technique, cannot be observed if the welding parameters are exactly adjusted to the welding components. Because of better results of manufacturing further investigations to adapt connecting material to the contact layer will be done by RC welding. Author (ESRO)

N69-24313# Central Mechanical Engineering Research Inst., Durgapur (India).
PROSPECTS OF SOLAR POWER PLANTS IN INDIA
M. M. Shah Aug. 1968 26 p refs
(M7) Avail: CFSTI

The theoretical and practical aspects of solar power plants are discussed and an assessment is made of the feasibility of building such plants in India. It is concluded that under present Indian conditions of materials' availability, fabrication facilities, etc., building of solar power plants would be advantageous in only a few special cases. Author

N69-24389*# Exotech, Inc., Washington, D. C. Systems Research Div.
A MODEL FOR SILICON SOLAR CELL PERFORMANCE IN SPACE Final Report
M. J. Barrett and R. H. Stroud 28 Feb. 1969 46 p refs
Prepared for JPL
(Contracts NAS7-100; JPL-952246)
(NASA-CR-100776) Avail: CFSTI CSCL 10B

Comparison of semiconductor theory, radiation effects theory, and reported experimental data permitted development of a mathematical model for predicting the performance of a solar cell under conbinations of radiation exposure, ambient temperature, and illumination spectrum. Limitations on the accuracy and applicability of the model are discussed for future study. Author

N69-24454# Army Electronics Command, Fort Monmouth, N. J.
STATE-OF-THE-ART ALKALINE CADMIUM
Otto C. Wagner Nov. 1968 20 p refs
(AD-680189; ECOM-3047) Avail: CFSTI CSCL 10/3

Alkaline cadmium anodes have been developed to deliver 0.30 ampere-hours per gram of electrode at the C/5 rate. These anodes are of the sponge type and maintain 80-85% of theoretical capacity when continuously cycled at 100% depth of discharge (C/5 rates of charge and discharge at room temperature). Loss of capacity of the cadmium anode is prevented by: (a) employment of 5-10% Fe2O3 or TiO2 extender, (b) elimination of carbonate within the unit cell, (c) moderate overcharging during initial cycling, and (d) charging at rates between C/5 and C/2. Shorting by cadmium penetration through the separator system is prevented by: (a) elimination of carbonate within the unit cell, (b) the employment of bibulous inert interseparators between the anode and main separator, and (c) keeping overcharge to a minimum. Author (TAB)

N69-24505*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
CASCADED THERMOELECTRIC TEST GENERATOR, PHASE 2 Quarterly Progress Report, 1 Dec. 1968–28 Feb. 1969
28 Feb. 1969 18 p Prepared for JPL
(Contracts NAS7-100; JPL-952196)
(NASA-CR-100775; WANL-PD(DDD)-005) Avail: CFSTI CSCL 10B

Primary interest during this period was on the fabrication of system components, on qualification testing of the sodium heat pipe, on emissivity tests of tantalum specimens coated with zirconia and alumina, and on the assembly of the SiGe stage to the heat pipe and subsequent delivery. This report includes a status summary of the major system components along with test results obtained where applicable. Author

N69-24520*# Hughes Aircraft Co., Culver City, Calif. Space Systems Div.
SURVEYOR BATTERY CALORIMETRIC AND CYCLE LIFE TESTS Final Report, 18 Mar. 1968–18 Mar. 1969
Mar. 1969 71 p Prepared for JPL
(Contracts NAS7-100; JPL-952226)
(NASA-CR-100780; SSD-90086R) Avail: CFSTI CSCL 10C

Surplus batteries from the Surveyor Program were tested and analyzed. The program was divided into two separate efforts: calorimetric studies over a wide range of charge and discharge regimes; and cycle life studies over a large number of temperature, charge, and discharge regimes. Measurements obtained on heat generation of nine unused Surveyor batteries demonstrated the effectiveness of the isothermal calorimeter and its automatic readout. Results of the cycle life studies showed that the batteries performed better than expected at 120°F and poorer than expected at 0°F. Activated age of the batteries at the start and end of test was a significant consideration. Author

N69-24882# Army Electronics Command, Fort Monmouth, N. J.
THERMOELECTRIC GENERATORS PP-8074()/U AND PP-8075()/U
Guido E. Guazzoni and Richard T. Nichols Dec. 1968 25 p refs
(AD-682722; ECOM-3089) Avail: CFSTI CSCL 10/2

The report describes engineering development studies on 10 Ampere, PP-8074( )/U, and 20 Ampere, PP-8075( )/U, 28 volt

d.c. power sources of the thermoelectric type to ascertain the validity of the mechanical design and to determine physical and electrical performance characteristics. The results of tests on a total of six units are related herein to the behavior of major subassembly components. Author (TAB)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N69-23442*# Midwest Research Inst., Kansas City, Mo.
APPLICATION OF AEROSPACE-GENERATED TECHNOLOGY TO WATER POLLUTION AND OTHER PUBLIC SECTOR PROBLEMS Quarterly Report, 1 Sep.–30 Nov. 1968
David Bendersky and Andrew J. Winfrey 30 Nov. 1968 22 p refs
(Contract NSR-26-002-083); MRI Proj. 3217-E)
(NASA-CR-100674; QR-2) Avail: CFSTI CSCL 13B

The definition of medical problems and the identification of potential solutions available in aerospace technology are primary objectives of this contract. Two supplementary tasks are reported here. One task is to conduct a planning study to provide a framework for matching aerospace-generated technology to needs and problems in the area of water pollution. Based on the results of the planning study, a minimum of 12 specific problems in the area of water pollution are to be selected and the applicability of aerospace-generated technology as potential solutions to each of these problems is to be determined. The second task provides five evaluation reports together with retrospective searches for selected public sector problems, solutions to which will be aided by the application of aerospace-generated technology. Author

N69-23494 Oregon State Univ., Corvallis.
THE EFFECTS OF ULTRAVIOLET IRRADIATION ON THE PHOTOSYNTHETIC APPARATUS
Kenneth Edward Mantai (Ph.D. Thesis) 1968 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-14483

The effects of ultraviolet (UV) irradiation on photosynthesis and various partial reactions involving the individual photoreactions of photosynthesis were examined. These reactions included photoreduction in adapted green algae, Hill reaction, cyclic photophosphorylation, the 520 nm absorbance change and variable-yield fluorescence. The reactions were measured in spinach chloroplasts and isolated chloroplasts or whole cells of green and blue-green algae. The effects of UV irradiation on the 520 nm absorbance change were also examined. Carotenoid, lipid and protein content and complement in irradiated and unirradiated chloroplasts and cells were also compared. Measurements were made of the effects of UV irradiation on the variable-yield fluorescence of isolated chloroplasts and whole cells. Dissert. Abstr.

N69-23507# Institute Rudjer Boskovic, Zagreb (Yugoslavia).
[THE UPTAKE, MAXIMUM CONCENTRATION, AND LOSS OF SELECTED RADIONUCLIDES BY REPRESENTATIVE ORGANISMS IN THE ADRIATIC SEA] Annual Report, Jul. 1965–Jun. 1966
Stjepan Keckes and Zvonimir Pucar Jun. 1968 287 p ref
(NP-17646) Avail: AEC Depository Libraries

Concentrations, uptake, and loss of selected radionuclides by representative organisms in the Adriatic Sea were determined. Investigations of conditions off the West Istrian coast included determinations of meteorological conditions, temperature, salinity, density, transparency, pH, oxygen, and phytoplankton. Radioecological investigations included determinations of radioisotopes in sediments, sea water, and marine organisms. A table is presented to show gross β radioactivity in species of algae, molluscs, echinoderms, and fish. Activities of ^{60}Co, ^{54}Mn, ^{106}Ru, and ^{65}Zn were determined in plankton. Physico-chemical studies of sea water included characterization and separation of ^{106}Ru by electromigration methods, polarographic investigations of cadmium, indium, and zinc, and precipitation and hydrolysis of thorium, zirconium, yttrium, and rare earths. Studies on uptake, concentration, and loss of radioisotopes by marine animals are included for mussels, shrimps and fishes. NSA

N69-23526# Rochester Univ., N. Y. Dept. of Radiation Biology and Biophysics.
DYNAMICS OF DUST REMOVAL FROM THE LOWER AIRWAYS: MEASUREMENTS AND INTERPRETATIONS BASED UPON RADIOACTIVE AEROSOLS
Paul E. Morrow 14 Aug. 1968 29 p refs Presented at the Symp. on Airway Dyn., Haverford, Pa.
(Contract W-7401-eng-49)
(UR-49-987; Conf-680814-1) Avail: CFSTI

Experimental studies on dust deposition in the respiratory tract are reviewed. It is pointed out that most laboratory studies use monodisperse particles, but such aerosols are rarely found in nature. Problems related to the anatomy and physiology of the respiratory tract, the physical properties and intrinsic instability of aerosols, the relation between particle size and deposition probability, the relation between particle number and mass in heterodisperse aerosols, and the development of suitable models of deposition for dust clouds and therapeutic aerosols are discussed. Two techniques using heterodisperse and monodisperse radioactive aerosols are described. It is concluded that, while both methods usually provide some information on particle clearance in different zones of the respiratory tract, there has been little success in utilizing the clearance of a radioactive aerosol as a bronchial or pulmonary function test. NSA

N69-23527# Washington State Univ., Pullman. Dept. of Agronomy.
FACTORS WHICH GOVERN PLANT RADIOSENSITIVITY Three-Year Summary Report, 1965–1968
R. A. Nilan and C. F. Konzak Nov. 1968 13 p refs
(Contract AT(45-1)-353)
(RLO-353-31) Avail: CFSTI

Progress is reported on studies of mechanisms by which radiation injuries are induced, prevented, and repaired in plant cells. Results are reported from studies on the effects of oxygen on the x-radiosensitivity of dry barley seeds. It was concluded that possible mechanisms by which oxygen pressure may induce biological damage in seeds include the accelerated rate of normal oxidative processes, the formation of peroxides, and the formation of long-lived free radicals. NSA

N69-23534*# Florida State Univ., Tallahassee. Dept. of Statistics.
EVALUATION OF A QUANTAL RESPONSE MODEL WITH VARIABLE CONCENTRATIONS

Richard G. Cornell 31 Mar. 1969 17 p refs
(Grant NGR-10-004-029)
(NASA-CR-100692; TR-17) Avail: CFSTI CSCL 06M

A quantal response model is presented that relates the probability of exposing one or more viable microorganisms, as the result of fracturing plastic rods, to the concentration of microorganisms within the plastic. In the initial analysis a maximum likelihood estimate of the only parameter involved was computed for each of four fracture areas studied using observed proportions of fractured plastic discs showing growth of bacterial spores and corresponding experimentally determined concentrations. The concentrations were assumed to be measured without error. When the model was evaluated using the calculated parameter estimates it was found that it did not describe the data adequately. In this paper an estimation procedure is developed for the concentrations which utilizes the observed proportions as well as the observed concentrations. Subsequent calculations like those carried out initially are illustrated and lead to practically the same estimates of the model parameter and its standard error, but dramatically reduce the chi-square statistic used to test the appropriateness of the model to a value somewhat less than its expectation. Author

N69-23569 North Carolina State Univ., Raleigh.
AN ANALYSIS OF THE CONTRIBUTION OF ALVEOLAR SURFACE PROPERTIES TO THE MECHANICS OF RESPIRATION
Joseph Patrick Archie, Jr. (Ph.D. Thesis) 1968 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-14642

The mechanics of external mammalian respiration is evaluated. A rationally motivated, one degree of freedom, scalar, mathematical model is developed from a statement of conservation of mass and surface thermodynamics to represent the contribution of pulmonary surfactant to the mechanics of respiration. This model predicts average values of the transalveolar surface pressure as a function of time for the whole lung. The model predicts the present value of pressure to be a function not only of the present lung volume but also the volume history. A computer is used to calculate theoretical pressure versus time and pressure versus volume curves from the programmed model equation with results displayed on an oscilloscope. An analytical tidal volume function is used to demonstrate a predicted rise in transpulmonary pressure and decrease in lung compliance with extended periods of tidal ventilation. Dissert. Abstr.

N69-23650*# Boeing Co., Seattle, Wash.
AUTOMATED PATIENT MONITOR
Huntsville, Ala. NASA. Marshall Space Flight Center. [1968] 65 p
(Contract NAS8-20793)
(NASA-CR-100666; MFS-14552) Avail: CFSTI CSCL 06B

The Automated Patient Monitor which is the direct application of telemetry system developed for and in support of the Saturn launch vehicle is described. A multichannel, lightweight telemetering equipment which would free the patient for normal activity was designed. Since the applications and requirements were very similar to existing systems within the launch vehicle telemetry system, it was relatively easy to devise a patient monitor which would satisfy the requirements, and which had the advantage of circuitry which had been proved during actual launches. Miniaturized and repackaged basic Saturn telemetry circuitry are shown. Since only a demonstration of the feasibility of such a system was required, no advantage was taken of the marked reductions in size and weight which can be achieved through modular and LSI techniques. The resulting system has performed well during demonstrations and is currently undergoing comparative tests at the MSFC Medical Center. Author

N69-23679# Gulf General Atomic, San Diego, Calif.
PULSE RADIOLYSIS STUDY OF PROTECTION OF PYRIMIDINE BASE COMPONENTS OF NUCLEIC ACID BY AMINOTHIOLS IN AQUEOUS SOLUTION Annual Summary Report, 22 Jun. 1967–21 Jun. 1968
L. P. Theard and F. C. Peterson 6 Sep. 1968 111 p refs
(Contract AT(OU-3)-167)
(GA-8872) Avail: CFSTI

Studies were made of the mechanisms by which ionizing radiation induces chemical transformation of purine and pyrimidine base components of nucleic acid and aminothiols present in dilute concentration in aqueous solutions. Results are presented for thymine, cysteine, cystine, DNA, and mixtures of DNA and cysteine. Author

N69-23711# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
THE EFFECTS OF ALCOHOL AT THREE SIMULATED AIRCRAFT CABIN CONDITIONS
E. Arnold Higgins, Audie W. Davis, Jr., John A. Vaughan, Gordon E. Funkhouser, and Elinore M. Gallerston Sept. 1968 17 p refs
(AM-68-18) Avail: CFSTI

In a study of 54 human subjects using three alcohol consumption levels and three simulated cabin conditions it was found that alcohol caused an increase in heart rate and an increase in skin temperature. Internal body temperature was lower with alcohol but did increase as blood alcohol levels decreased. The performance tests used apparently were not critical enough to detect differences due to single influences. Blood alcohol determinations for subjects receiving the high level of alcohol yielded significantly higher levels of blood alcohol for subjects at 200,000 ft. than at the other altitudes. However, the readings at 20,000 ft. were not significantly different than readings obtained at the other altitudes for subjects receiving the lower dose of alcohol. Author

N69-23719# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
DRUG AND TOXIC HAZARDS IN GENERAL AVIATION
J. Robert Dille and Stanley R. Mohler Sep. 1968 9 p refs
Presented at Tex. Med. Assoc. Meeting, Houston, Tex., 2 May 1968
(AM-68-16) Avail: CFSTI

Pilot factors cause about 80% of general aviation aircraft accidents. Numerous articles have reported a high incidence of drug involvement in automobile accidents, and of alcohol involvement in both automobile and aircraft accidents. Pesticide poisoning has been found in about one-third of aerial application accidents in two small studies. Carbon monoxide is another real, but relatively rare, cause of general aviation accidents. This paper discusses both the potential and the documented roles of drugs, alcohol, pesticides and carbon monoxide in general aviation accidents; the need for further study; and the need for education to reduce the incidence of involvement of these factors. Author

N69-23735 California Univ., Berkeley.
BINOCULAR INTERACTION IN ANIMALS AND MAN
Colin Brian Blakemore (Ph.D. Thesis) 1968 232 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.00 Order No. 68-13885

Single neurons were investigated in the cat primary visual cortex. Most of these units are maximally sensitive to an oriented target presented to a limited part of the visual field of either eye. It was shown that for maximal binocular stimulation of any unit the paired retinal images must be positioned rather exactly on the two receptive fields. Human observers made relative depth judgments between two slit targets on the basis of pure disparity

cues. Stereoacuity is maximal at fixation and declines if the targets are moved away from the fixation point, either into the periphery or in depth. In the latter case the fall in acuity with absolute disparity of the targets is roughly exponential, confirming an observation of Ogle. Dissert. Abstr.

N69-23782# Joint Publications Research Service, Washington, D. C.
SOME BIONIC ASPECTS OF SELF-ORGANIZATION
Yu. M. Gasparyan et al 26 Mar. 1969 7 p refs Transl. into ENGLISH from Biol. Zh. Arm. (Erevan), v. 21, no. 11, 1968 p 74–78
(JPRS-47724) Avail: CFSTI

Problems related to self-organization of living organisms are considered. Self-organization is defined as the capability of living organisms for adaptation to changing environments. This characteristic depends on the interaction of the organism and the surroundings, and the internal reorganization depends on the expenditure of free energy. The organism must compensate for this loss of energy by absorption of nutrients. A simplified model of the behavior of an organism is presented. An algorithm for the functioning of an automaton, and computer results are included. F.O.S.

N69-23801# Oak Ridge National Lab., Tenn.
HEALTH PHYSICS DIVISION Annual Progress Report for the Period Ending 31 Jul. 1968
Oct. 1968 289 p refs
(Contract W-7405-eng-26)
(ORNL-4316) Avail: CFSTI

CONTENTS:

1. RADIOACTIVE WASTE DISPOSAL K. E. Cowser p 1–70 refs (See N69-23802 12-04)
2. RADIATION ECOLOGY S. I. Auerbach p 71–160 refs (See N69-23803 12-04)
3. RADIATION PHYSICS R. D. Birkhoff and R. H. Ritchie p 161–230 refs (See N69-23804 12-04)
4. RADIATION DOSIMETRY RESEARCH J. A. Auxier p 231–270 refs (See N69-23805 12-04)
5. INTERNAL DOSIMETRY W. S. Snyder p 271–320 refs (See N69-23806 12-04)

N69-23802# Oak Ridge National Lab., Tenn.
RADIOACTIVE WASTE DISPOSAL
K. E. Cowser, comp. *In its* Health Phys. Div. Oct. 1968 p 1–70 refs (See N69-23801 12-04)
Avail: CFSTI

Soils and sediments were analyzed for phosphorous content. Hydraulic fracturing methods were investigated for reducing the expense of locating radioactive waste disposal sites. Investigations were carried out on the disposal of radioactive wastes in a salt mine in Kansas. A study was made of the dose equivalents of radioactivity a normal man receives while working at a nuclear fuel reprocessing plant. Research on microscopic measurements of the elastic properties of rocks was carried out to determine the stress conditions on the rocks, thereby enabling earthquake possibility predictions to determine the feasibility of locating nuclear reactor sites. Models were developed and programmed to estimate expected radiation doses to populations in various hypothetical exposure situations related to peaceful uses of nuclear explosives. B.G.D.

N69-23803# Oak Ridge National Lab., Tenn.
RADIATION ECOLOGY
S. I. Auerbach, comp. *In its* Health Phys. Div. Oct. 1968 p 71–160 refs (See N69-23801 12-04)
Avail: CFSTI

Data from radiation and hematological effects studies on mammals were utilized for comparisons of radiation mortality in the hemopoietic death of mammals. Studies of the effects of external beta radiation on higher plants were initiated to determine radiosensitivities of native plant species and to provide estimates of the ecological effects of postattack fallout on plants. A study was carried out on the radioisotope transport in terrestrial microcosmic ecosystems of plants and the radioisotope uptake by living and nonliving components of aquatic ecosystems. B.G.D.

N69-23804# Oak Ridge National Lab., Tenn.
RADIATION PHYSICS
R. D. Birkhoff, comp., and R. H. Ritchie, comp. *In its* Health Phys. Div. Oct. 1968 p 161–230 refs (See N69-23801 12-04)
Avail: CFSTI

An evaluation was made of mean excitation energies for some 36 compounds and mixtures of importance in radiation dosimetry. Calculations were made of the ground-state energy eigenvalues for an electron moving in the field of a stationary electric dipole. The optical properties of liquid water in the vacuum ultraviolet spectral region were measured for the first time in the physics of tissue damage program. B.G.D.

N69-23805# Oak Ridge National Lab., Tenn.
RADIATION DOSIMETRY RESEARCH
J. A. Auxier, comp. *In its* Health Phys. Div. Oct. 1968 p 231–270 refs (See N69-23801 12-04)
Avail: CFSTI

A dosimetry study was made for survivors of the nuclear bombings of Hiroshima and Nagasaki, and the energy yield of the Hiroshima bomb was calculated. A health physics research reactor was used for dosimetry, radiobiology, and radiobotanical investigations. A study was made on the accurate and absolute calibration of neutron and gamma-ray spectrometers. B.G.D.

N69-23806# Oak Ridge National Lab., Tenn.
INTERNAL DOSIMETRY
W. S. Snyder, comp. *In its* Health Phys. Div. Oct. 1968 p 271–320 refs (See N69-23801 12-04)
Avail: CFSTI

A study was made of the excretion levels of plutonium in hospital patients receiving a single intravenous injection of plutonium. A computer program was developed for estimating the absorbed fraction of gamma energy in organs of the body. A method was developed for removal of phosphate from solutions of bone ash to facilitate the spectrographic determination of impurities in this material. B.G.D.

N69-23860# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
[BIOCHEMISTRY, BIOPHYSICS, NUCLEAR MEDICINE, ENVIRONMENTAL RADIATION, AND RADIOBIOLOGY] Semiannual Progress Report, Period Ending 30 Jun. 1968
30 Jun. 1968 84 p refs
(Contract AT(04-1-GEN-12)
(UCLA-12-686) Avail: CFSTI

Progress is reported on the development of radioisotope scanning procedures for use in the diagnosis of neoplasms or in physiological studies in patients. Sequential scanning with ^{131}I-rose bengal was of value for the diagnosis of hepatic bile duct obstruction and cirrhosis. The limitations of quantitative lung scanning using using ^{131}I-albumin macroaggregates for measurements of

regional blood flow were investigated in dogs. Comparative semiquantitative studies using ^{133}Xe gas indicated that peripheral deposition of inhaled aerosols in the respiratory tract is proportional to ventilation and it was concluded that ventilation studies with ^{133}Xe can be used clinically to differentiate ischemia from primary vascular occlusion from most other causes of regional ischemia. Studies on the uptake of ^{99}Tc-pertechnetate and ^{197}Hg by human brain tumor cells in vitro indicated a possible cell-type specificity for these radioisotopes. NSA

N69-23864# Suffield Experimental Station, Ralston (Alberta).
THE EFFECT OF ILLUMINATION BY PARAFLARES DURING NIGHT FIRING ON NIGHT VISION
J. D. Heine Jan. 1969 7 p
(Suffield-Memo-136/68) Avail: Issuing Activity

An investigation was conducted to determine the effect of miosis on night vision. Light levels were measured during a live firing exercise, involving four 106 mm recoilless anti-tank weapons and four 81 mm mortars providing illumination. The effects of the varying light conditions were determined by the use of a standard eye chart. No impairment of night vision was shown. Author

N69-23883*# Martin Marietta Corp., Baltimore, Md.
A PARAMETRIC STUDY TO DETERMINE TIME-TEMPERATURE-VACUUM RELATIONSHIPS FOR STERILIZATION OF TERRESTRIAL SPORES, PHASE 1
Summary Report, Period Ending 18 Apr. 1969
James A. Brierley and Stanley E. Podlaseck Apr. 1969 38 p refs
(Contract NAS9-9261)
(NASA-CR-99627; MCR-69-195) Avail: CFSTI CSCL 06M

Spores of *Bacillus* sp. G2, *Bacillus* subtilis var niger, and *Clostridium* sporogenes were exposed to temperatures of 25, 70, 90 and 110°C at atmospheric or vacuum (10^{-6} Torr) pressure for periods of 2 and 20 hours. No effect of vacuum pressure was noted for spore survival at 25°C. At 70°C *bacillus* sp. G2 and *B. subtilis* var niger spores were not affected at atmospheric pressure and *Cl.* sporogenes spores demonstrated slight susceptibility, D-value 13.81. At the vacuum pressure *B. subtilis* spores were not affected, but *Bacillus* sp. G2 spore D-value was 4.31 and *Cl.* sporogenes spore D-value was 4.48. *Cl.* sporgenes had little resistance to 110°C with D-values of 4.34 at atmospheric pressure and 4.51 at vacuum pressure. It may be stated that generally vacuum pressure (10^{-6} Torr) increases the susceptibility of spores to temperature. Author

N69-23890# Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
A PERSPECTIVE ON CURRENT AIR POLLUTION PROBLEMS
P. K. Zutshi 1968 88 p refs
(BARC-355) Avail: CFSTI

Air pollution sources and its effects on property, vegetation, and public health are discussed. Pollutants and their sources are identified, and wind, diurnal, seasonal, urban, and topographic effects are described. The pollutant concentrations are estimated for India, and the contributions to the problem by industries, transportation, and urbanization are indicated. N.E.N.

N69-23930# School of Aerospace Medicine, Brooks AFB, Tex.
ENDOCRINE-METABOLIC RESPONSES TO PARACHUTING
Final Report, Feb.–Jul. 1968
Gordon K. Lochridge, Henry B. Hale, and Edgar W. Williams Aug. 1968 12 p refs
(AD-680400; SAM-TR-68-72) Avail: CFSTI CSCL 6/16

This was a feasibility study in which the usefulness of urinalysis for the assessment of stress in parachutists was tested. Eight sport parachutists were studied, each collecting urine specimens on two separate occasions, with each specimen representing a 2-hour period which included ascent to altitude, the jump, and a postjump rest period. The urinary determinations included epinephrine, norepinephrine, 17-hydroxycorticosteroids, magnesium, potassium, sodium, phosphorus, urea, and creatinine. Creatinine served as the base to which the other eight constituents were referred. The individual urinary constituents, when expressed as percent of respective control values and averaged, gave a single value for the endocrine-metabolic response, the so-called stress index or score. Five of the jumpers were novices whose jumps were made at lower altitudes than were used by the remaining 3 jumpers who were highly experienced. Sympathoadrenomedullary stimulation of high degree was evident for all but one of the jumpers, but few of the jumpers showed evidence of adrenocortical stimulation or of metabolic hyperactivity. The stress score was 162% for the novice group, 225% for the experienced group, and 186% for the entire group. The latter value differed significantly from zero ($P < .001$). Author (TAB)

N69-23937*# Techtran Corp., Glen Burnie, Md.
EVOLUTION OF THE BIOCHEMICAL FUNCTIONS OF THE BIOSPHERE [OB EVOLIUTSII BIOGEOKHIMICHESKIKH FUNKTSII BIOSFERY]
Ye. A. Boychenko Washington NASA Apr. 1969 8 p refs Transl. into ENGLISH from the Publ. "Abiogenez i Nachal'Nyye Stadii Evoliyutsii Zhizn" Moscow, Nauka Press, 1968 p 103–108
(Contract NASw-1695)
(NASA-TT-F-12134) Avail: CFSTI CSCL 06A

The changes which have transformed the ancient anaerobic biosphere into the present oxidized biosphere are examined. The evolution of oxidation-reduction reactions of photosynthesis is traced. Changes in the ratio of metals in plants are discussed as indices of evolutionary progress. Morphological changes which have led from algae to highly differentiated plants are examined. Author

N69-23938*# Techtran Corp., Glen Burnie, Md.
NUCLEIC ACIDS AND EVOLUTIONARY SYSTEMATIZATION [NUKLEINOVYYE KISLOTY I EVOLYUTSIONNAYA SISTEMATIKA]
A. N. Belozerskiy Washington NASA Apr. 1969 11 p refs Transl. into ENGLISH from the Publ. "Abiogenez i Nachal'Nyye Stadii Evoliyutsii Zhizn" Moscow, Nauka Press, 1968 p 81–91
(Contract NASw-1695)
(NASA-TT-F-12145) Avail: CFSTI CSCL 06A

The author discusses experimental data concerning the composition of nucleic acids, specifically DNA, in relation to the evolutionary systematization of microbes, plants, and animals. The main conclusion is that DNA, which forms the basis of the species specificity of organisms, may serve as one of the most important criteria for determining the systematic position of a group of organisms. Author

N69-23948*# Techtran Corp., Glen Burnie, Md.
STATE AND PROBLEMS OF STUDIES OF THE PROBLEM OF THE ORIGIN OF LIFE [SOSTOYANIYE I ZADACHI ISSLEDOVANIY PO PROBLEME PROISKHOZHDENIYA ZHIZNI]

A. I. Oparin Washington NASA Apr. 1969 7 p Transl. into ENGLISH from the Publ. "Abiogenez i Nachal, Nyye Stadii Evoliyustsii Zhizn" Moscow, Nauka Press, 1968 p 5–10
(Contract NASw-1695)
(NASA-TT-F-12186) Avail: CSFTI CSCL 06A

It is contended that the beginning of life on earth should be considered as a process of gradual formation of carbon compounds of increasing complexity which compose multimolecular systems. Stages of this process are outlined as (1) the formation of hydrocarbons and their closest derivatives during the formation of the earth's crust, the atmosphere, and the hydrosphere; (2) the transformation of carbon compounds on the earth's surface into more complex organic compounds; (3) further formation and multiplication of open systems capable of reacting with the ambient medium; and (4) further evolution of carbon compounds into primordial organisms by means of prebiological selection. Author

N69-24005# Advisory Group for Aerospace Research and Development, Paris (France).
BIONICS SYMPOSIUM
Sep. 1968 49 p refs Meeting held at Brussels, 18–20 Sep. 1968
(AGARD-ES-3) Avail: CFSTI

Summary data are presented on biological mechanisms and models to aid in understanding learning processes, sensory perception, and other neurophysiological functions. For individual titles, see N69-24006 through N69-24035.

N69-24007# Stanford Univ., Calif. Dept. of Electrical Engineering.
ON MODELLING THE NERVOUS SYSTEM
Michael A. Arbib *In* AGARD Bionics Symp. Sep. 1968 1 p
(See N69-24005 12-04)
Avail: CFSTI

Abstracted data are given on a model for a cybernetic brain. An understanding of the central nervous system was one of the goals of the study. B.P.

N69-24009# Edinburgh Univ. (Scotland). Bionics Research Lab.
PRINCIPLES OF INFORMATION PROCESSING
Richard L. Gregory *In* AGARD Bionics Symp. Sep. 1968 1 p
(See N69-24005 12-04)
Avail: CFSTI

The interpretative aspects or meaning involved in information processing in autonomous systems such as brains is briefly considered. The objective realities and their significance are discussed in relation to their image patterns. B.P.

N69-24011# California Univ., Los Angeles. Space Biology Lab.
LEARNING FROM THE BIOLOGICAL POINT OF VIEW
W. Ross Adey *In* AGARD Bionics Symp. Sep. 1968 3 p refs (See N69-24005 12-04)
Avail: CFSTI

A survey of the literature on biological learning covered the following topics: (1) the general character of learning processes in biological systems; (2) anatomy and physiology of cerebral ganglia; (3) relationship between EEG wave patterns and learning; (4) new evidence of the nature of the cerebral neuronal membrane; and (4) a model of neuronal organization in learning. B.P.

N69-24015# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
NEUROPHYSIOLOGICAL PRINCIPLES OF AUDITORY INFORMATION PROCESSING
J. Ryland Mundie *In* AGARD Bionics Symp. Sep. 1968 1 p
(See N69-24005 12-04)
Avail: CFSTI

The transformation of an auditory signal is traced to better understand the neurophysiological principles of auditory information processing. Auditory mechanisms are time dependent; experiments indicated that very accurate measures of time and periods of time as short as one tenth of a millisecond can be demonstrated. The ability to perform statistical measurement in the dimension of time is the outstanding characteristic of auditory neural function. B.P.

N69-24016# Edinburgh Univ. (Scotland). MRC Speech and Communication Research Unit.
CEREBRAL MECHANISMS OF SPEECH
Richard C. Oldfield *In* AGARD Bionics Symp. Sep. 1968 3 p
(See N69-24005 12-04)
Avail: CFSTI

Pathways of speech are catalogued, specifically those directed towards the mechanisms to be found in the cerebral cortex. A distinction is drawn between the form of speech and its linguistic content; disorders or damages to the cortical centers are discussed in relation to their effects on these two aspects. Also considered is the interrelationship and intercommunication of the higher centers of the cortex and peripheral organs in speech acts. B.P.

N69-24019# Syracuse Univ., N. Y. Lab. of Sensory Communication.
VIBROTACTILE INFORMATION TRANSFER
J. J. Zwislocki *In* AGARD Bionics Symp. Sep. 1968 1 p
(See N69-24005 12-04)
Avail: CFSTI

The possibility of integration of vibrotactile characteristics with relevant auditory characteristics was demonstrated as a method of speech communication. Systematic data was collected on vibrotactile detectability as a function of vibration frequency, contactor area, stimulus duration, and variation in temporal pattern. By applying such concepts as spatial and temporal summation, it was possible to show that two functionally different systems respond to vibrotactile stimulation; one integrates over space and time and the other does not. B.P.

N69-24021# Institute for Perception RVO-TNO Soesterberg (Netherlands).
THE INTERPRETATION OF COMPLEX VISUAL STIMULI
P. L. Walraven *In* AGARD Bionics Symp. Sep. 1968 1 p
(See N69-24005 12-04)
Avail: CFSTI

The interpretation of TV pictures was examined as a function of image degradation. The pictures were produced with a flying spot scanner system. Degradation was achieved by varying the line frequency and by adding noise. The pictures were vehicles on a uniform background, only one vehicle per picture. The objects were divided into three groups with respect to size. Each group consisted of two real and one pseudo vehicle. Eight subjects were instructed to indicate which objects were imaged on the picture presented. Scores were plotted as a function of line frequency for three signal to noise ratios and three different groups of vehicles. Author

N69-24023# University Coll., London (England). Dept. of Electrical Engineering.

NEURONAL MODELS OF PATTERN RECOGNITION AND LEARNING MECHANISM IN THE BRAIN

W. K. Taylor *In* AGARD Bionics Symp. Sep. 1968 5 p refs (See N69-24005 12-04)

Avail: CFSTI

The performance of the memory synapse in learning machines is reviewed. An attempt is made to understand and postulate the synaptic transmission or gain changes the basic memory element undergoes in a neuronal model. Mathematical formulae are derived for a memory synapse with transmission to account for saturation, normalization, and prevention of neuron overdrive in the models. B.P.

N69-24025 IIT Research Ins., Chicago, Ill.

OLFACTORY INFORMATION PROCESSING AND MECHANISMS

Andrew Dravnieks *In* AGARD Bionics Symp. Sep. 1968 1 p (See N69-24005 12-04)

Avail: CFSTI

The physiological role of olfactory organs to deal with the reception of airborne stimuli consisting of molecular species or their mixtures is reviewed. Studies by various methods, including factor analysis of psychophysical data and analyses of the informational capacity of the olfactory channels, indicated that in humans probably not more than nine parameters of molecular species participate to provide the discriminating power of the olfactory sense. The merits and interpretative aspects of artificial sensors are also discussed. B.P.

N69-24027# Glasgow Univ. (Scotland).

METHOD FOR THE ANALYSIS OF THE NEURAL MECHANISMS FOR POSTURAL ADJUSTMENTS

T. D. M. Roberts and D. J. Murray-Smith *In* AGARD Bionics Symp. Sep. 1968 1 p refs (See N69-24005 12-04)

Avail: CFSTI

Research was carried out to determine how the nervous system uses the incoming sensory messages to construct its motor commands. The strategy adopted is one based on modeling. The case is considered where the sensory input to the labyrinthine reflexes produces its effects in the extensor muscles of the limbs by modifying the sensitivity of their stretch reflexes. The final output command, in the form of an impulse stream in the alpha motoneurons, reflected the interacting influences of signals in many pathways, including those that affect the servo loop through intrafusal control of the muscle spindles. Predictive relationships are found that will describe what changes are made in each of the relevant control signals when there is a change in the signal from the labyrinth. An adaptive model was constructed of the stretch reflex and the changes seen in this were correlated with the changing signal from a model representing the sensory apparatus of the labyrinth. Author

N69-24028# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

FUNCTIONS OF THE VESTIBULAR SYSTEM IN HUMAN GUIDANCE AND CONTROL

Laurence R. Young *In* AGARD Bionics Symp. Sep. 1968 2 p refs (See N69-24005 12-04)

Avail: CFSTI

Bionic models of the vestibular system were developed after a thorough investigation of the characteristics of the human system. Experimental stimuli familiar to control engineers for system identification were used, including rotation and linear acceleration impulses, steps, ramps, sinusoids, and random continuous signals. A physical analog model is also presented of the vestibular system. The model consisted of a three gimbal head containing three rate gyroscopes and six linear accelerometers, and a special purpose analog computer simulating the dynamics and nonlinearities of the nonauditory labyrinth. B.P.

N69-24029# Centre National de la Recherche Scientifique, Marseilles (France). Institut de Neurophysiologie et Psychophysiologie

BIONICS OF MUSCULAR STRETCH RECEPTORS

Jacques Paillard *In* AGARD Bionics Symp. Sep. 1968 3 p refs In FRENCH (See N69-24005 12-04)

Avail: CFSTI

The working mechanisms of muscular stretch receptors, their feedback controls, and motor stability are reviewed. The functional neurophysiological implications of their dynamic and static responses are assessed with a view towards developing biological models using the combined efforts of physiologist and engineer. Transl. by B.P.

N69-24031# Michigan Univ., Ann Arbor. Mental Health Inst.

MECHANISMS OF BIOLOGICAL MEMORY

Rudolf J. von Baumgarten *In* AGARD Bionics Symp. Sep. 1968 1 p (See N69-24005 12-04)

Avail: CFSTI

Biological memory mechanisms are reviewed. It was shown that heterosynaptic facilitation has in the same cell unspecific components of sensitization, as well as specific components which could help to explain short term memory. Other experiments were conducted on the temporal conditioning of single neurons. Hypotheses are presented, based on the experimental evidences, for the information storage and retrieval functions of memory. B.P.

N69-24032# State Univ. of New York at Buffalo.

MODELING THE ASSOCIATIVE MEMORY FUNCTION

Vincent E. Giuliano *In* AGARD Bionics Symp. Sep. 1968 1 p (See N69-24003 12-04)

Avail: CFSTI

Although improved understanding of the processes of mental association and recall of concepts has been an important objective of scholars and philosophers since the beginning of organized knowledge, the explanations that have emerged through the millenia have been largely theoretical and quite untestable. In the last fifteen years, a new class of models and explanations has been evolving mathematical and simulation models that are constructible and testable using electronic information processing technologies. Some classes of models amenable to digital computer simulation are surveyed, and a particular type is explored in some depth. This is a network model for representing relationships of contiguity, similarity, and synonymy among linguistic representations of concepts. Author

N69-24034# Wildfowl Trust, Slimbridge (England).

BIRD NAVIGATION

G. V. T. Matthews *In* AGARD Bionics Symp. Sep. 1968 1 p (See N69-24005 12-04)

Avail: CFSTI

Hypotheses are presented for the directional tendencies of birds. One suggests that comparisons are made between the highest point of the sun arc at release compared with the remembered values at home. The other current thought requires measurement of the instantaneous altitude and the rate of change of altitude of the

sun. While it is not possible to decide between the two at present, the evidence that some form of sun navigation is involved continues to accumulate. B.P.

N69-24044# School of Aerospace Medicine, Brook AFB, Tex.
INTRAOCULAR DYNAMICS OF DOGS EXPOSED TO NEAR-VACUUM PRESSURES Technical Report, Jan.–Jun.1968
Stanley C. Knapp, John D. Albright, and Julian P. Cooke Sep 1968 13 p refs
(AD-680402; SAM-TR-68-89) Avail: CFSTI CSCL 6/19

Four mongrel dogs were individually decompressed to 200 torr (200 mm. Hg, absolute) while breathing oxygen, and then rapidly decompressed to a near-vacuum pressure as represented by 2 torr for a 2-minute exposure. Observations of intraocular pressure and retinal appearance were made before exposure and after recompression to ground-level pressure. Increased intraocular pressure, engorgement of the central and peripheral veins, narrowing of the peripheral arterioles, paling of the disc and peripheral retina, and cupping of the disc were observed. Intravascular bubbles were not seen, but a small flame-type hemorrhage was seen in the eye of one animal. Retinal appearance tended to return to the pre-exposure state within about 45 minutes. The observed modifications appear to be of a temporary nature and probably do not account for the blindness or impaired vision that sometimes occurs in humans and lasts for several hours after accidental exposure to markedly reduced pressures. Author (TAB)

N69-24057# Library of Congress, Washington, D. C. Aerospace Technology Div.
BIOMEDICAL PROBLEMS AND TECHNOLOGY (BIOINSTRUMENTATION) SURVEYS OF FOREIGN SCIENTIFIC AND TECHNICAL LITERATURE
Bettye P. Flippo 30 Apr. 1969 225 p refs Prepared for Army, Med. Intelligence Office
(ATD-69-58) Avail: CFSTI

A commentary and 218 abstracts on biomedical technology are presented, based on Soviet and satellite open source literature covering the period July 1966 through December 1968. The subject matter pertains to cardiovascular and circulatory systems; nervous and sensory systems; respiratory system and anesthesia; surgery, transplantation, and body temperature regulation; laboratory equipment and techniques; electrical equipment and recording devices; limb and organ protheses; radiation and electromagnetic spectrum equipment; computers and computer technology; and ultrasonics. Author

N69-24159# Israel Program for Scientific Translations, Ltd., Jerusalem.
NITROGEN-FIXING PROPERTY AND DISTRIBUTION OF OLIGONITROPHILOUS ACTINOMYCETES IN GORNO-ALTAI SOILS
I. L. Klevenskaya *In its* Genesis of the Soils of Western Siberia 1968 p 72–78 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

Actinomycete distribution, and species composition in soils at different elevations were studied, as well as the biological fixation of atmospheric nitrogen by these microorganisms. It was found that their absolute and relative numbers in different vertical zones of the region increased considerably with the transition from high mountain to low mountain soil. In the low mountain soil, a significant number was recorded even in the winter months; an exceedingly large population was found in fall. It was concluded that the soils of the Gorno-Altai are clearly distinguished by the species spectrum and a proportion of individual species of oligonitrophilous actinomycetes. Some of the species have nitrogen fixing properties, and it emphased that, together with other oligonitrophilous microorganisms, these bacteria are instrumental in the nitrogen enrichment of soil. A.C.K

N69-24160# Israel Program for Scientific Translations, Ltd., Jerusalem.
INTENSITY OF AEROBIC DESTRUCTION OF CELLULOSE IN RELATION TO THE NITROGEN COMPOUNDS IN GORNO-ALTAI SOILS
N. N. Naplekova *In its* Genesis of the Soils of Western Siberia 1968 p 79–84 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

Aerobic cellulolytic microorganisms in leached chernozem and meadow chernozem soils for the area were examined in the laboratory, using a oil plating method, and in natural conditions by embedding cloth in the soil. It was found that the soils are characterized by high potential fertility, with considerable reserves of humus, phosphorus and nitrogen. An excellent granular structure was discovered, as well as a tendency toward a slightly acid reaction (a water ph in meadow chernozem soil of 6.2 and of 6.3 in leached chernozem). It was concluded that the type of soil and nature of nitrogen nutrition greatly influenced the intensity of cellulose destruction; and, further, that the shift of predominance in the soils of the cellulolytic species in certain months could result from the dynamics of soluble forms of nitrogen during the growing season. A.C.K

N69-24161# Israel Program for Scientific Translations, Ltd., Jerusalem.
EXPERIMENT WITH MINERAL FERTILIZERS ON GRAY FOREST SOILS IN THE NOVOSIBIRSK REGION
V. P. Shapovalov et al *In its* Genesis of the Soils of Western Siberia 1968 p 85–91 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

The general agrochemical properties of gray forest soils, the dynamics of nutrients in them, and the effectiveness of various combinations of mineral fertilizers added under wheat were investigated. These soils, which develop on sandy and loamy alluvial-deluvial deposits on upper river terraces in the region, are strongly pulverized, structureless and show low permeability to air and water. In addition, it was found that they are clearly poor in mobile forms of nitrogen and potassium, but rich in mobile phosphoric acid. Mineral fertilizer additions once a year cause a considerable increase in the yield of wheat, maize, and other crops. Nitrogen fertilizers, in particular, exert a strong effect; while a perceptible increase in yield is evidenced by adding microelements, especially together with mineral fertilizers. The qualitative composition of the crops, such as albumin content, is also improved by these additives, and the experimental methods appear to be commercially practical. A.C.K

N69-24177# Oak Ridge National Lab., Tenn. Health Physics Div.
THE EFFECTS OF BIOTIC COMPLEXITY AND FAST NEUTRON RADIATION ON CESIUM 137 AND COBALT 60 KINETICS IN AQUATIC MICROCOSMS
H. L. Ragsdale (Ph.D. Thesis—Tenn. Univ., Oak Ridge). J. F. Witherspoon, and D. J. Nelson
(Contract W-7405-eng-26)
(ORNL-4318) Avail: CFSTI

Aquatic microcosms consisting of various combinations of physical components and biological components were used to determine the effect of increased biotic complexity on mineral cycling parameters. The stability of mineral cycling parameters was tested by stressing selected complexity levels with sublethal and lethal doses of fast neutron radiation. The value of microcosms as ecological research units is discussed. Author (NSA)

N69-24183# Atomic Energy Commission, Las Vegas, Nev. Operations Office.
RUSSIAN RADIOECOLOGY: A BIBLIOGRAPHY OF SOVIET PUBLICATIONS WITH CITATIONS OF ENGLISH TRANSLATIONS AND ABSTRACTS
Alfred W. Klement, Jr., Charles F. Lytle (Penn. State Univ., Univ. Park), and Vincent Shultz (Washington State Univ.) Oak Ridge, Tenn. Sep. 1968 131 p refs
Avail: CFSTI

References to 1340 works by Soviet scientists in the direct and indirect interest of radioecology are included. Most of the references are dated after 1955, but the total time period covered is 1916 to 1968. The titles are all translated, and where English translations of the articles are available, that fact is indicated. NSA

N69-24198# Israel Program for Scientific Translations, Ltd., Jerusalem.
BIOLOGICAL OBSERVATIONS
K. A. Brodskii et al *In its* The Sixth Voyage of R/V "OB" 1968 p 177–199 (See N69-24191 12-13)
Avail: CFSTI

Plankton was sampled at a total of 75 oceanographic stations, using gauze net No. 38 with an entrance aperture of 80 cm, and an Okean winch with a 5.1 mm cable. Due to the limited time spent at oceanographic stations, only one complete vertical sampling was performed, from the surface down to 200 m. Plankton forms according to the stations are listed. At Antarctic stations the development stages of the dominant Calanidae species are indicated in addition to specific composition. Quantitative assessments are based on a visual scale and give an idea of the quantitative ratios of the plankton sample components. It will be seen that Antarctic plankton species are relatively limited. The dominant Calanidae species are: Calanus acutus, Calanus propinquus, Metridia gerlachei, while the Rhincalanus gigas, Paraeuchaeta antarctica, and Drepanopsis frigidus species are less numerous. Euphausiacea were mainly represented by young stages (calyptopic and furcilla), while adults were less numerous. Author

N69-24243# Army Natick Labs., Mass. Pioneering Research Lab.
THE UTILIZATION OF MILITARY ANTHROPOMETRY FOR AIRCRAFT COCKPIT DESIGN
Robert M. White *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 2 p refs (See N69-24230 12-02)
Avail: CFSTI

The utilization of military anthropometry is discussed in terms of the collection and analyses of the data and the application of these data in aircraft cockpit design. It is concluded that new techniques of measurement and new methods of presentation of the data are required. More emphasis needs to be placed on functional or dynamic measurements of the seated operator, in addition to the traditional static measurements of a rigidly posed subject. P.A.B.

N69-24245# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.
PILOTS' ASSESSMENT OF THEIR COCKPIT ENVIRONMENT
J. F. Murrell *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 2 p refs (See N69-24230 12-02)
Avail: CFSTI

Assessment by the user pilot is an important source of information as to the efficiency of aircraft display and control systems. Information of value to life scientists and engineers can be gained and reduced to quantitative form by use of open ended questions. A study is reported in which 229 civilian airline pilots responded to five open ended questions about design and layout of their cockpits. They most often criticized their radio and navigation aids. Application of these results is discussed. Author

N69-24276*# Techtran Corp., Glen Burnie, Md.
ANALOG COMPUTER INVESTIGATIONS WITH A MATHEMATICAL MODEL FOR THE REGULATION MECHANISM OF CALCIUM METABOLISM [ANALOGRECHNER-UNTERSUCHUNGEN AN EINEM MATHEMATISCHEN MODELL ZU DEM REGULATIONSMECHANISMUS DES KALZIUMSTOFFWECHSELS]
A. Habermehl et al Washington NASA Apr. 1969 9 p Transl. into ENGLISH from German Federal Min. for Sci. Res. Rept. W68-30 Presented at the 2d meeting on Extraterrest. Biophys., Biol. and Space Med., Marburg, West Ger., 9–10 Oct. 1967
(Contract NASw-1695)
(NASA-TT-F-12151) Avail: CFSTI CSCL 06P

Calcium losses observed in astronauts following their participation in space flights prompted this study. The model is a quantitative expression of the regulatory mechanism for keeping the serum calcium level constant. The mathematical interrelation of the functional structure of the calcium metabolism is outlined, and the corresponding differential equations are presented. Analog computer calculations were performed for a number of realistic abnormal situations in the calcium metabolism. Author

N69-24277*# Techtran Corp., Glen Burnie, Md.
INTER- AND INTRA-INDIVIDUAL DESYNCHRONIZATION WITHIN AN ISOLATED GROUP [INTER- UND INTRAINDIVIDUELLE DESYNCHRONISATION INNERHALB EINER ISOLIERTEN GRUPPE]
E. Poeppel Washington NASA Apr. 1969 8 p refs Transl. into ENGLISH from German Federal Min. for Sci. Res. Rept. W68-30 Presented at the 2d Meeting on Extraterrest. Biophys., Biol. and Space Med., Marburg, West Ger., 9–10 Oct. 1967
(Contract NASw-1695)
(NASA-TT-F-12152) Avail: CFSTI CSCL 06P

An experiment is described in which four male human subjects were isolated as a group for three weeks. Recorded were the periods of activity and rest, electrolyte concentration in urine, body temperature, and psychomotor tempo. Various socio-psychological tests and self-appraisals were also conducted. The spontaneous periodicity of the subjects was compared with the normal 24-hour-day rhythm, and the test data were evaluated for the ability of the individuals to live as a group. Author

N69-24278*# Techtran Corp., Glen Burnie, Md.
THE CONDITIONAL INDEPENDENCE FROM GRAVITY OF DEVELOPMENT OF THE POLAR DIFFERENTIATION EGG [UBER DIE BEDINGTE UNABHANGIGKEIT DER ENTWICKELUNG DES POLAR DIFFERENZIRTEN EIES VON DER SCHWERKRAFT]
L. Katheriner Washington NASA Apr. 1969 12 p refs Transl. into ENGLISH from Arch. Entwicklungsmech. Organ. (Berlin), v. 12, 1901 p 597–609
(Contract NASw-1695)
(NASA-TT-F-12149) Avail: CFSTI CSCL 06C

In an experiment in which frog eggs were allowed to develop in a rising current of air bubbles, in order to impart irregular

motion and thus eliminate the force of gravity as a factor in their development, the eggs developed normally, but somewhat more slowly than eggs in stagnant water. The author attributed the slower development to lower water temperature resulting from increased evaporation. Author

N69-24315# Argonne National Lab., Ill. Health Div.
GAMMA-RAY SPECTROSCOPY GROUP Research Report, Jul 1965–Jun. 1968
Jul. 1968 102 p refs
(Contract W-31-109-eng-38)
(ANL-7461) Avail: CFSTI

The incidence of radium-induced malignant tumors and blood dyscrasias was related to current or preterminal radium burden measurements and to retrospective estimates of maximum radium burdens for a series of 293 persons, most of whom acquired radium burdens in the period 1918 to 1933. The 46 malignant diseases included 23 bone sarcomas, 16 neoplasms of the skull (principally mastoid and paranasal air cell carcinomas), and 7 leukemias and aplastic anemias. Retrospective estimates of maximum radium burdens were made by application of the appropriate power function for ingestion or for multiple injections. Based on the estimated maximum initial burden, the data imply at least a twelve-fold margin of safety in the maximum permissible level for internally deposited radium. Author (NSA)

N69-24328# Battelle Memorial Inst., Columbus, Ohio. Remote Area Conflict Information Center.
PHYSIOLOGICAL FACTORS RELATING TO TERRESTRIAL ALTITUDES: A BIBLIOGRAPHY
L. Yvonne Wulff, Irene A. Braden, F. H. Shillito, and J. F. Tomashefski 1968 746 p refs
(Contracts F33657-67-C-0810; ARPA SD-171)
(AD-680474) Avail: CFSTI CSCL 6/16

The bibliography contains 4,000 references relating to the environmental and biological factors pertaining to terrestrial altitudes between 5,000 and 27,000 feet. Each entry consists of complete bibliographic data. TAB

N69-24328 Defence Research Board, Ottawa (Ontario).
THE EFFECT OF BLOCKAGE OF ALL SIX SEMICIRCULAR CANAL DUCTS ON NYSTAGMUS PRODUCED BY DYNAMIC LINEAR ACCELERATION IN THE CAT
M. J. Correia and K. E. Money Dec. 1968 16 p refs
(DRET-728) Avail: Issuing Activity

Seven cats were given rotary tests about an earth-vertical axis and also about an earth-horizontal axis. They were tested with the sagittal head plane in the plane of rotation as well as with the horizontal head plane in the plane of rotation. Recordings of eye movements were made during the tests. Following surgical transection and blocking of all six semicircular canal ducts, the cats were tested again. It was found postoperatively that horizontal and vertical nystagmus in response to angular acceleration about an earth-vertical axis were abolished. Nystagmus during constant velocity rotation about an earth-horizontal axis remained, however, although the slow phase eye velocity and frequency of the nystagmus were reduced. It is suggested that, although continuity of the semicircular canal ducts is necessary for the nystagmus in response to angular accelerations about a vertical axis, it is only contributory (and not necessary) for the nystagmus during constant velocity rotation about an earth-horizontal axis. These findings and conclusions are discussed in the context of existing data and theory. Author

N69-24358*# California Univ., Berkeley. Sea Water Conversion Lab.
STUDY OF PERMEABILITY CHARACTERISTICS OF MEMBRANES Quarterly Report, 9 Nov. 1968–9 Feb. 1969
K. S. Spiegler, J. C. T. Kwak, D. A. Zelman, and J. Leibovitz 9 Feb. 1969 13 p Prepared for JPL
(Contracts NAS7-100; JPL-952109)
(NASA-CR-100777; QR-5) Avail: CFSTI CSCL 06C

Improvements in the apparatus for the measurements of transport properties of permselective membranes are described. These improvements include increased stability of the concentration feedback mechanism and alterations in the experimental set up to decrease the volume losses in the cell. Measurements of thickness, wet weight, ion-exchange capacity, and water content of the membrane to be used for the transport experiments are reported. Author

N69-24386# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
SPHEROIDAL PARTICLE FLOW IN A CYLINDRICAL TUBE
Tio C. Chen and Richard Skalak Nov. 1968 104 p refs
(Contract N00014-67-A-0108)
(AD-680455; TR-2) Avail: CFSTI CSCL 20/4

Viscous flow in a circular cylindrical tube containing an infinite line of rigid spheroidal particles equally spaced along the axis of the tube is considered for (a) uniform axial translation of the spheroids (b) flow past a line of stationary spheroids and (c) flow of the suspending fluid and spheroids under an imposed pressure gradient. The fluid is assumed to be incompressible and Newtonian. The Reynolds number is assumed to be small and the equations of creeping flow are used. Two types of solutions are developed for each case (i) an exact solution in the form of infinite series which is valid for ratios of the spheroid diameter to the tube diameter up to 0.80. (ii) an approximate solution using lubrication theory which is valid for spheroids which nearly fill the tube. The drag on each spheroid and the pressure drop are computed for all cases. Both prolate and oblate spheroids are considered. The results show that the drag and pressure drop depend on the spheroidal diameter perpendicular to the axis of tube primarily and the effects of the spheroidal thickness and spacing are secondary. The results are of interest in connection with mechanics of capillary blood flow, sedimentation, fluidized beds, and fluid-solid transport. Author (TAB)

N69-24397*# National Aeronautics and Space Administration, Washington, D. C.
CHANGES IN CORTICOSTEROID AND CATECHOLAMINE METABOLISM AFTER SHARP LIMITATION OF MOTOR ACTIVITY [IZMENIYA KORTIKOSTEROIDNOGO I KATEKHOLAMINOVOGO OBMENA PRI REZKOM ORGANIZMA GRANICHENII DVIGATEL'NOY AKTIVNOSTI ORGANIZMA]
V. V. Parin et al Apr. 1969 3 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 184, no. 1, 1969 p 250–251
(NASA-TT-F-12211) Avail: CFSTI CSCL 06P

Hypokinesis was induced in sixteen experimental male rabbits and sixteen controls, weighing three to four kg each, by keeping them in cages especially designed to reduce motor activity to a minimum. As the animals lost weight during the experiment, the sides of the cages were drawn together to force the animals to remain immobile. The rabbits were sacrificed 11 to 12 and 30 days after the start of the experiment. The contents of oxycorticosteroids in blood plasma and of norepinephrine and epinephrine in the adrenals, myocardium, and hypothalamus were determined

fluorometrically. Experimental results showed that the sharp limitation of motor activity severely impaired the animals' corticosteroid and catecholamine metabolism. P.A.B.

N69-24430# Army Natick Labs., Mass. Food Lab.
GROWTH OF PLANT CELL CULTURES. 2: NUTRIENT REQUIREMENTS AND THEIR ROLE IN THE GROWTH OF SUSPENSION CULTURES
Mary Mandels, Judith Jeffers, and Hamed M. El-Bisi Oct. 1968 80 p refs
(AD-680230; FL-83; TR-69-36-FL) Avail: CFSTI CSCL 6/13

A detailed study has been made of some nutrient requirements of several plant cell suspension cultures. These cultures require the usual inorganic salts including inorganic nitrate nitrogen. Hydrolyzed protein or amino acids will serve as the sole source of nitrogen for growth, but organic nitrogen is not required. Urea or ammonia nitrogen in the absence of nitrate will not support growth. Sucrose is an excellent carbon source. Glucose and starch will also support growth of some cultures. Sucrose sterilized by gamma irradiation supports normal growth of these cultures. Growth is retarded on glucose sterilized by gamma irradiation at ambient temperature, but growth is normal on glucose irradiated at -80C. A few growth factors at low concentration are also required. An auxin (2,4 dichlorphenoxyacetic acid or naphthaleneacetic acid) and thiamine are required by all cultures. Kinetin (6 furfurylaminopurine) is also required by some cultures. Maximum productivity on this simple medium is about 1.5 grams dry weight per liter of culture per day, equal to, but not significantly greater than productivities obtained on much more complex media. Author (TAB)

N69-24431# TRW Systems, Redondo Beach, Calif.
BIOMECHANICS STUDIES ON DYNAMIC SHAPE RECOGNITION Final Technical Report
Gabriel E. Lowitz Nov. 1968 38 p refs
(Contract DAHC04-68-C-0016)
(AD-680237; TRW-10493-6001-R0-00; AROD-7820-1-RT) Avail: CFSTI CSCL 6/4

This report documents the experimental reduction to practice of the concept of dynamic shape recognition, an optical processing scheme applicable to the recognition of geometrical objects in photographic imagery. The concept involves the use of the motion of the sensor as a prime means of recognition. The appendix to this report contains additional theoretical studies useful for the implementation of the concept covering the noise analysis of the stochastic process involved. Author (TAB)

N69-24450# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
PROBLEMS OF DISTRIBUTION AND EXPERIMENTAL EVALUATION OF PERMISSIBLE LEVELS OF 137CS, 90SR, AND 106RU
L. A. Buldakov and Yu. I. Moskalev 1968 51 p Transl. into ENGLISH from the Russian
(Contract AT(29-2)-1013
(AEC-TR-6972) Avail: CFSTI

Distribution patterns of radioisotopes in mice, rats, guinea pigs, and farm animals were analyzed. The kinetics of ^{137}Cs and ^{90}Sr metabolism in man were also investigated. Secretion of radioisotopes in milk and transmission to progeny were studied. Data were analyzed for the purpose of determining permissible levels of radioisotopes in air, water, and food. Tables are presented to show distribution of ^{106}Ru in various organs of mice and rats and maximum permissible levels of ^{106}Ru in air, water, and food. NSA

N69-24476# Technische Hochschule Munchen (West Germany).
THE INFLUENCE OF PALMITYL CARNITINE ON THE BIOLOGICAL TERMINAL OXIDATION [DER EINFLUSS VON PALMITYLCARNITIN AUF DIE BIOLOGISCHE ENDOXYDATION]
Rudolf Ludwig Portenhauser (Ph.D. Thesis) 1968 23 p refs In GERMAN
Avail: CFSTI

The changes in rat liver mitochondries by fatty acids and acylcarnitine concentrations are studied and the effects of palmitylcarnitine on the terminal biological oxydation are outlined. Experiments show that small concentrations of palmitylcarnitine stimulate succinate ventilation in intact rat liver mitochondries whereas large palmitylcarnitine doses inhibit ventilation. Pathologica organisms, especially diabetics, exhibit increased concentrations of acyl carnitite chains in their metabolic systems. Transl. by G.G.

N69-24480# Technische Hochschule Munchen (West Germany).
DETERMINATION OF TRITIUM ISOTOPE EFFECTS IN DEHYDROGENASE REACTIONS OF THE CARBOHYDRATE METABOLISM AND THEIR MECHANISTIC INTERPRETATION [BESTIMMUNG VON TRITIUM-ISOTOPENEFFEKTEN BEI DEHYDROGENASEREAKTIONEN DES KOHLENHYDRATSTOFFWECHSELS UND IHRE MECHANISTISCHE DEUTUNG]
Walter Rambeck (Ph.D. Thesis) 16 Dec. 121 p refs In GERMAN
Avail: CFSTI

Determined were tritium isotope effects on some dehydrogenase reactions in glucose metabolism and their reaction kinetics in similar enzyme reactions. Isotopic measurements on nicotinesamide-adenine-dinucleotide(-phosphate) related dehydrogenases in vitro showed that catalytic reactions took place in unordered substrate bonds of the enzymes and that hydride transfer determined the reaction velocity. This effect was valid for the whole temperature range of possible enzyme reactions. Transl. by G.G.

N69-24491# Joint Publications Research Service, Washington, D. C.
SOVIET MEDICAL RESEARCH IN ANTARCTICA
7 Apr. 1969 26 p refs Transl. into ENGLISH from the Book "Trudy Sovetskoy Antarkticheskoy Ekspeditsii, vol. 48" Leningrad, Hydrometeorological Publishing House, 1967 p 329-346
(JPRS-47795) Avail: CFSTI

CONTENTS:

1. PECULIARITIES OF THE COURSE OF REPARATIVE PROCESSES IN ANTARCTICA (EXPERIMENTAL INVESTIGATIONS) G. A. Bareshkov p 1-14 refs (See N69-24492 12-04)
2. CHANGES IN THE CARDIOVASCULAR SYSTEM IN PERSONNEL OF HIGH-ALTITUDE STATIONS AND PARTICIPANTS IN SLED-TRACTOR EXPEDITIONS I. V. Shustin p 15-18 (See N69-24493 12-04)
3. EXPERIENCE OF MEDICAL SERVICES AT THE TRANSCONTINENTAL STATION OF VOSTOK IN THE PERIOD OF THE 1960 ANTARCTIC EXPEDITION N. V. Bystrov p 19-24 (See N69-24494 12-04)

N69-24492# Joint Publications Research Service, Washington, D. C.
PECULIARITIES OF THE COURSE OF REPARATIVE PROCESSES IN ANTARCTICA (EXPERIMENTAL INVESTIGATIONS)
G. A. Barashkov *In its* Soviet Med. Res. in Antarctica 7 Apr. 1969 p 1–14 refs (See N69-24491 12-04)
Avail: CFSTI

The vital activities of the organism and the condition of its reactive and defense forces depend on a whole series of interrelations of the organism with the external world, reflecting the unity of the organism with the surrounding environment. This interdependence is manifested with particular clarity when people from the middle latitudes of the Northern Hemisphere migrate to Antarctica. Under the influence of factors indigenous to the South Polar climate, the rhythm of the physiological reactions of the organism is disturbed and meteoneuroses of nonadaptation develop. The organism possesses large adaption possibilities; nevertheless, the prolonged residence of man in these new and extremely severe conditions produces a stress situation affecting all of the adaption mechanisms. This stress condition of the adaption mechanisms induces in the reactive mechanism changes that are undoubtedly reflected in the course of pathological processes, including circulation and the healing of wounds. Author

N69-24493# Joint Publications Research Service, Washington, D. C.
CHANGES IN THE CARDIOVASCULAR SYSTEM IN PERSONNEL OF HIGH-ALTITUDE STATIONS AND PARTICIPANTS IN SLED-TRACTOR EXPEDITIONS
I. V. Shastin *In its* Soviet Med. Res. in Antarctica 7 Apr. 1969 p 15–18 (See N69-24491 12-04)
Avail: CFSTI

Medical observations are presented on personnel of the Vostok Station prior to their flight from Mirnyy, and at the termination of winter year, after their return to the observatory. The personnel of the sled-tractor caravan were under observation on the route from Mirnyy to Komosomol'skaya Station. The first complaints of slight headaches, pains in the cardiac region, dyspnea caused by rapid walking, and loss of appetite appeared a month after the beginning of the expedition, at an altitude of only 3,000 meters above sea level. A rise in arterial pressure was observed in three of the people at this time. A week later, at the beginning of 1960, the condition of the personnel began to improve. Only K, an engineer 43 years of age, in whom a bundle-branch block was cardiographically diagnosed, continued to complain of pains in the cardiac region, while in I, a glacialist, the headaches became severe against a background of further elevation of arterial pressure. Author

N69-24494# Joint Publications Research Service, Washington, D. C.
EXPERIENCE OF MEDICAL SERVICES AT THE TRANSCONTINENTAL STATION OF VOSTOK IN THE PERIOD OF THE 1960 ANTARCTIC EXPEDITION
N. V. Bystrov *In its* Soviet Med. Res. in Antarctica 7 Apr. 1969 p 19–24 (See N69-24491 12-04)
Avail: CFSTI

The physical factors of Antarctica to a certain degree have a negative effect on the human organism, inducing specific physiological reorganizations. To these must be added the morale-mental factor evoked by prolonged separation of the small collective from the civilized world, relatives, and close friends. The collective group of the station arrived at Vostok by plane at the beginning of January 1960. From conditions of normal atmospheric pressure, plus temperatures, and normal air content of oxygen, the human organism, in a short period of time—5–6 hours, was thrust into conditions of low atmospheric pressure, reduced air humidity, and air temperature of minus 40 degrees. Changes took place in cardiovascular and respiratory systems. Author

N69-24498# Brookhaven National Lab., Upton, N. Y.
THE ROLE OF HUMAN GUIDANCE IN A FAST MEASUREMENT SYSTEM
P. L. Connolly, W. C. Delaney, P. V. C. Hough, J. M. Howie, R. R. Kinsey et al 25 Oct. 1968 9 p Presented at the Intern. Conf. on Advan. Data Processing for Bubble and Spark Chambers, Argonne, Ill., 28–30 Oct. 1968 Sponsored by AEC
(BNL-13060; Conf-681025-10) Avail: CFSTI

The design of advanced computer based film analysis systems for bubble chambers and its relation to the role of human guidance in film scanning are discussed. NSA

N69-24591# Southwest Research Inst., San Antonio, Tex.
A LOW FIELD ELECTRON SPIN RESONANCE STUDY OF THE EFFECT OF RADIATION IN LIVING ANIMALS Final Report
Frank C. Whitmore and Charles E. Bryson Sep. 1968 79 p refs
(Contract DA-49-146-XZ-560)
(AD-680624; DASA-2153) Avail: CFSTI CSCL 6/18

It has been demonstrated that free radicals are formed in living systems as a consequence of exposure of these systems to various kinds of ionizing radiation. In addition, it has been shown that it is possible to obtain the environmental conditions necessary to produce ESR while simultaneously maintaining those necessary for the survival of a living test specimen. It has been also demonstrated that a conveniently used, highly reproducible electronic system can be developed for the operation and control of an L-band spectrometer. Author (TAB)

N69-24593# Johns Hopkins Univ., Baltimore, Md. Dept. of Psychology.
THE EVOLUTION OF PERCEPTUAL FRAMES OF REFERENCE
Albert William Bevin, Jr. et al Dec. 1968 42 p refs
(Contract N00014-67-A-0163-0001; Grant NSF GB-5287)
(AD-680462; TR-57; TR-58; TR-59; TR-60) Avail: CFSTI CSCL 5/10

Contents: Does context influence the shape of a perceptual scale; The role of the thematic relationship between focal and contextual stimuli in recall; Structure in the classification of stimuli differing on several continuous attributes; and Incentive motivation and choice reaction time performance. TAB

N69-24632# United Kingdom Atomic Energy Authority, Harwell (England). Authority Health and Safety Branch.
PERSONNEL DOSE ASSESSEMENTS FOLLOWING ACCIDENTAL NON-UNIFORM IRRADIATION OF THE BODY
W. A. Langmead, N. Adams, B. Holliday (UKAEA, Dounreay, Scotland), G. Tyler (UKAEA, Dounreay, Scotland), and James Brown (UKAEA, Dounreay, Scotland) Sep. 1968 49 p refs
(AHSB(RP)R-85) Avail: CFSTI; HMSO 7s

An incident which involved the accidental exposure to external radiation of two men on the floor of the experimental fast reactor at Dounreay was reconstructed. The reconstruction, carried out in order to determine the radiation doses received by the two men, necessitated the filming of stages in the incident using a dummy source, the measurement of the dose-rate distribution around an

irradiated fuel element and its simulation using ^{137}Cs point sources, the measurement of the dose-rate distribution around a man-phantom containing $^{137}CsCl_2$ solution, and the measurement of depth doses in a water phantom irradiated by a fuel element. These experimental measurements enabled the determination of doses to the men's eyes, gonads, hands and skin, and also the distribution of dose with depth at the waist level of one of the men. By making use of the reciprocal dose theorem, the integral doses and average doses to the bodies of the men were also determined. A short discussion of the validity of the reconstruction and the accuracy attainable is presented. Author (NSA)

N69-24643# Roscoe B. Jackson Memorial Lab., Bar Harbor, Maine.

QUANTITATIVE POPULATION GENETICS OF MICE UNDER IRRADIATION, 1 JUNE 1965–31 MAY 1968

Earl L. Green, and Thomas H. Roderick 30 Jun. 1968 17 p refs

(Contract AT(30-1)-1979

(NYO-1979-26) Avail: CFSTI

Nonirradiated descendants of irradiated and nonirradiated randombred sublines of populations of mice were compared with respect to lifespan and body weight. Nonirradiated descendants of irradiated and nonirradiated sublines of two populations of mice were compared with respect to lifetime reproductive performances, including percentages of fertile matings, mean numbers of litters, mean litter sizes, percentages of survival between birth and weaning, mean total numbers of progeny, and mean numbers of days of reproductive life. Other experiments were conducted to study recessive visibles, lethals, heritability, and inbreeding coefficients. Studies on genetic variants included determination of effects of deleterious recessives in heterozygotes of natural and radioinduced mutations and biochemical polymorphisms. NSA

N69-24666# Naval Ship Research and Development Center, Annapolis, Md.

AIR CAN BE CLEANED (FOR BREATHING)

W. R. Calvert Dec. 1968 24 p refs

(AD-680432; MATLAB-275) Avail: CFSTI CSCL 6/11

Life support, during ventures away from earths atmosphere, requires man-made system capability to provide clean air for breathing and to carry wastes (material and energy) to disposal. In this system, small fires and contaminant emitters must be controlled. Adsorption is essential to this systems process, which includes other phenomena for cleaning air. Author (TAB)

N69-24678# Federation of American Societies for Experimental Biology, Bethesda, Md.

PROMISING RESEARCH AREAS. 1: A STUDY OF THE BIOLOGICAL EFFECTS OF CHEMICAL SUBSTANCES EMPLOYING THE CONCEPTS AND TECHNIQUES OF PHYSICAL CHEMISTRY

J. F. A. Mc Manus Nov. 1968 67 p refs

(Contract DAHC19-68-C-0001)

(AD-680227) Avail: CFSTI CSCL 6/1

This report summarizes recent investigations that relate physical changes in macromolecular protein structures to biological functions. It is based on a review by scientists studying protein structure changes induced by van der Waals forces; model cell membrane systems that measure the functions of the enzyme permeases; the biological applications of nuclear magnetic resonance and electron spin resonance spectra and spin-labeling techniques; fluorescence spectra, polarization and decay times, and absorption spectroscopy as indicators of biological events; and the significance of molecular geometric changes in a series of biologically active compounds as related to their chemical structure. The topics include the nature of changes produced by chemicals at cell surfaces, enzyme-substrate interactions, novel concepts of charge transport through biological substrates, and their relationship to fine-structure changes in living systems. Author (TAB)

N69-24701# Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry.

INACTIVATION OF SOME ENZYMES IN AQUEOUS SOLUTION BY ATOMIC HYDROGEN

Gabriel Stein Apr. 1968 21 p refs Presented at Conf. on Energetics and Mech. in Radiation Biol., Port-Meirron, Wales, Apr. 1967 Submitted for publication

(Contract AT(30-1)-3242)

(NYO-3242-26; Conf-670422-1) Avail: CFSTI

Methods for quantitative study of the mechanisms and rate constants of the reactions of H atoms as the only reactive species in aqueous solutions were developed. The results on solutions of enzymes such as cytochrome-c, chymotrypsin, trypsin, and ribonuclease are discussed. It is shown that in these complex molecules highly specific reactions occur, effecting the metal ion, when present, and aromatic as well as divalent-sulfur-containing amino acids. Author (NSA)

N69-24714# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.

RADIATION SHIELDING FOR SMALL POWER SOURCES OF Tm-170, Tm-171

S. Marshall Sanders, Jr., William J. Kerrigan, and Edward L. Albenesius Jan. 1969 18 p refs

(Contract AT(07-2)-1)

(DP-1158) Avail: CFSTI

Dose equivalent rates measured with a 6.8 W $^{07.171}Tm$ source shielded with tantalum agreed closely with rates calculated from the number and energy distribution of bremsstrahlung photons from the beta decay of ^{170}Tm. This excellent agreement validated the calculational method. Shielding requirements were estimated for a hypothetical 62 W power source of ^{171}Tm for the projected artificial heart application; the calculations suggest a required purity range of 10^{-4} to 10^{-5} Ci ^{170}Tm Ci ^{171}Tm for ^{171}Tm implanted in the human body. Author (NSA)

N69-24726# Deutsche Versuchsanstalt fuer Luft- Und Raumfahrt, Bad Godesberg (West Germany).

BONDINGS IN BIOLOGICAL IRON-PORPHYRIN CHELATES [BINDUNGEN IN BIOLOGISCHEN EISEN-PORPHYRIN-CHELATEN]

G. Schaefer Dec. 1968 95 p refs In GERMAN; ENGLISH summary

(DLR-FB-68-87) Avail: CFSTI

The biological synthesis of the prosthetic groups of hemoproteids show a high sensitivity to oxygen. The variety of reactions catalyzed by these proteids depends especially on the type of chemical bonding and therefore on the configuration of the 3d electrons of the iron ion in the center of the porphyrin ring. Although these 3d electrons have no primary part in the chelation, the function of the hexacoordinated heavy-metal complex is extensively modified by the participation of the d-electrons in π bondings of chelates. The primordial existence of the porphyrins seems to be strongly associated with the chemical origin of life, while the extremely high resonance stability of these compounds is in agreement with their spontaneous synthesis. The most important hemoproteids which have been differentiated by common genetic sources are discussed with respect to their type of bonding and their selective function. Author

N69-24729# National Academy of Sciences–National Research Council, Washington, D. C.
SUMMARY OF WORKING GROUP ACTIVITY FROM 1952 TO 1968 OF THE COMMITTEE ON HEARING, BIOACOUSTICS, AND BIOMECHANICS
Dec. 1968 50 p refs
(Contract Nonr-2300(03))
(AD-680454) Avail: CFSTI CSCL 6/16

Research in the fields of hearing, bioacoustics, and biomechanics over an extended period is reviewed. Topics include biological effects of noise, automatic audiometry, psychoacoustics, auditory perception, sonic boom effects, requirements for air and missile base noise surveys, bioacoustic aspects of rocket, missile, and space travel, community noise problems, sonar studies, and speech analysis. In most of the areas studied an attempt was made to establish standards and evaluation criteria for the various acoustic factors. A.C.R.

N69-24733# Texas Univ., Houston. Anderson (M.D.) Hospital and Tumor Inst.
RADIATION AND BIOPHYSICAL STUDIES ON VIRUSES AND CELLS Progress Report, 12 Oct. 1967–11 Oct. 1968
Robert J. Shalek 14 Oct. 1968 24 p refs
(Contract AT(40-1)-2832)
(ORO-2832-74) Avail: CFSTI

Following irradiation of chromosomes from cultured hamster cells, studies on their structure were conducted using electron microscopy. Techniques for high resolution stereo microscopy are described. Studies were conducted on ultracentrifugal characterization of double stranded DNA isolated from normal and x-irradiated metaphase chromosomes. Studies on the effects of low energy electron beams on mammalian cells indicated that the major radiosensitive structure was a thin peripheral shell close to the nuclear membrane in the interphase cells and a considerably thicker peripheral shell in metaphase cells. Similar studies on other types of cells showed that the major radiosensitive region was in the form of a thin shell located directly below the bacteriophage, spore and bacterial surfaces, or close to the nuclear surface of yeast cells. Studies were conducted on absorption of 20 eV to 50,000 eV electron beams in air and plastic and angular scattering of 0.5 to 80 keV electrons by collodion foils. NSA

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N69-23622*# Florida State Univ., Tallahassee. Dept. of Statistics.
BIOSTATISTICS AND SPACE EXPLORATION: MICROBIOLOGY AND STERILIZATION
Richard G. Cornell 1 Apr. 1969 12 p
(Grant NGR-10-004-029)
(NASA-CR-100636) Avail: CFSTI CSCL 06M

Statistical models were formulated for spacecraft decontamination and related microbial life studies. Investigated were the following problems: (1) release of bacterial spores from fractured lucite; (2) bacterial spore growth of fractured plaster disks; (3) planetary quarantine probability models; and (4) parameter estimation in exponential decontamination models. G.G.

N69-23665*# Little (Arthur D.), Inc., Cambridge, Mass.
PRELIMINARY DESIGN OF AN EXTRAVEHICULAR TUNNEL-SUIT SYSTEM Final Report, 9 Aug. 1968–9 Mar. 1969
David L. Richardson 10 Mar. 1969 41 p refs
(Contract NAS9-8472)
(NASA-CR-99603; C-70710) Avail: CFSTI CSCL 06K

A preliminary design for an extravehicular tunnel-suit system for use in orbital extravehicular operations is presented. The study included the generation of basic technical concepts and approaches to the design of semi-anthropomorphic tunnel-suit systems for orbital vehicle crew members to perform extravehicular inspection, repair, maintenance, and data pack retrieval, and a determination of their feasibility. Conclusions are: (1) The tunnel-suit system is technically feasible. (2) Fabrication of all components of the tunnel-suit system is within the present state of the art of soft and hard suit technology. (3) The activity station where the astronaut performs extravehicular activities should be large enough for the astronaut to have access to the inside of the pass-through hatch required for passing tools, data packs, and other equipment to the space environment. (4) Insulation and micrometeoroid protection will be required on the tunnel-suit system in order to maintain a comfortable environment and to minimize the heat load imposed on the parent spacecraft environmental control system. Author

N69-23698*# Martin Co., Baltimore, Md.
COMPARATIVE STUDY OF HEAT REJECTION SYSTEMS FOR PORTABLE LIFE SUPPORT EQUIPMENT Final Report
Donald A. Myers and F. Arthur Grossman Apr. 1969 103 p refs
(Contract NAS9-8184)
(NASA-CR-99619; MCR-69-51) Avail: CFSTI CSCL 06K

It was determined that currently available heat rejection system hardware with some improvement should be utilized in the next generation of portable life support systems (PLSS) for missions requiring less than forty hours of either earth orbital or lunar surface EVA per man. For missions of greater than forty hours of EVA per man the development of a regenerative heat storage unit is recommended with the option of a hybrid heat storage/heat rejection sink for some applications. For missions requiring greater than fifty hours per man of lunar surface EVA, serious consideration of the employment of a lunar radiator cart is recommended. Successors to the recommended next generation of PLSS heat rejection system were also considered. A potential candidate in this category is the suit integral diffusion–vaporization system for missions requiring less than forty hours of EVA per man. Author

N69-23842*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A TECHNIQUE FOR IDENTIFYING PILOT DESCRIBING FUNCTIONS FROM ROUTINE FLIGHT-TEST RECORDS
Rodney C. Wingrove and Frederick G. Edwards Washington Mar. 1969 33 p refs
(NASA-TN-D-5127) Avail: CFSTI CSCL 06B

The problem of identifying the input-output relationship of the pilot by use of measured data from routine flight operations in which the pilot provides feedback control is considered. The problem in using the measured input and output data directly is that any extraneous output noise by the pilot causes an error in identification. This problem is solved by the development of a computer processing technique that, under certain conditions, yields an estimate relatively free from identification error. A theoretical analysis to show that this technique will reduce the identification error is presented. The simulation and identification of several known system elements are included to compare with the theory

and to illustrate the use of this technique. Also, results obtained from the retrofire phase of the Gemini X mission are presented to demonstrate the application of this technique to routine flight-test records. Author

N69-24008# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
BIONICS AND BIOENGINEERING IN AEROSPACE RESEARCH
Henning E. von Gierke *In* AGARD Bionics Symp. Sep. 1968 1 p refs (See N69-24005 12-04)
Avail: CFSTI

The overall objectives of the program are summarized. Topics included: the principles of locomotion of living systems; principles of advanced information processing in living systems with its enviable properties of reliability and adaptability; learning systems and adaptive control systems; visual pattern recognition; auditory pattern recognition; chemoreception; orientation in force fields; motion control; and energetics. B.P.

N69-24009# Paris Univ. (France). Inst. Marey.
INFORMATION PROCESSING PRINCIPLES USED IN LIVING SYSTEMS [PRINCIPES DU TRAITEMENT DE L INFORMATION PAR LES SYSTEMES VIVANTS]
A. Fessard *In* AGARD Bionics Symp. Sep. 1968 2 p In ENGLISH and FRENCH (See N69-24005 12-04)
Avail: CFSTI

The modus operandi of biological information processing is briefly summarized. The processes are analyzed at each separate level of operation and comparisons are attempted with artificial machines. The biological pattern recognition function is used as the best example for an information processing model. B.P.

N69-24010# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
PATTERN RECOGNITION
Hans L. Oestreicher *In* AGARD Bionics Symp. Sep. 1968 1 p (See N69-24005 12-04)
Avail: CFSTI

The problem areas of pattern recognition are briefly discussed after a review of its present and potential applications. The problem areas considered are: (1) the establishment of classes and significant features; (2) design of proper feature abstraction techniques; (3) design of proper decision making mechanisms; and (4) mechanisms which establish new classes automatically in response to the set of incoming signals. B.P.

N69-24012# Sussex Univ., Brighton (England). Lab. of Experimental Psychology.
THEORIES OF LEARNING SYSTEMS
A. Uttley *In* AGARD Bionics Symp. Sep. 1968 1 p (See N69-24005 12-04)
Avail: CFSTI

The theories involved with the development of learning systems are briefly discussed for binary and analog inputs. Mathematical models describe the logical functions of the two systems. B.P.

N69-24013# Adaptronics, Inc., McLean, Va.
ADAPTIVE FLIGHT CONTROL SYSTEMS
Roger L. Barron *In* AGARD Bionics Symp. Sep. 1968 2 p (See N69-24005 12-04)
Avail: CFSTI

Techniques of engineering bionics were focused on the adaptive flight control problem with considerable success. The key factors in this effort were the realization of guided random search techniques and methods for fast assessment of the results of search experiments. The particular guided random search technique which was developed is known as the probability state variable search algorithm. Author

N69-24014# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
POTENTIAL APPLICATIONS OF LEARNING SYSTEMS
J. F. Schouten *In* AGARD Bionics Symp. Sep. 1968 2 p (See N69-24005 12-04)
Avail: CFSTI

The technological implications of the learning characteristics of animals are assessed with a view towards developing machines which can benefit from experience trials, so called adaptive systems. B.P.

N69-24017# Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
SPEECH PROCESSING AND RECOGNITION [TRAITEMENT ET RECONNAISSANCE DE LA PAROLE]
Leonid Pimonow *In* AGARD Bionics Symp. Sep. 1968 1 p In FRENCH (See N69-24005 12-04)
Avail: CFSTI

A comparative analysis is made between hearing mechanisms and technical systems. Emphasis is placed on the frequency thresholds, amplitude, time, and progressive reduction of these data in auditory information processing. Also discussed is the variation of informational delivery in the time allowed by the physiological properties of the ear and the relation of this variation of delivery with intelligibility. Synthetic language techniques are considered and evaluated from the viewpoint of the informational capacity of the hearing vestiges of deaf mutes. Transl. by B.P.

N69-24018# Laboratoire de Physiologie Acoustique, Jouy-en-Josas (France).
BIOLOGICAL ECHOLOCATION [ECHOLOCATION BIOLOGIQUE]
R. G. Busnel *In* AGARD Bionics Symp. Sep. 1968 1 p In FRENCH (See N69-24005 12-04)
Avail: CFSTI

An assessment is made of the points of accord which should exist and the divergences which do exist between the biologist and engineer in problems dealing with echolocation. The traditional barriers between biological and engineering research institutions are discussed with a view to establishing a symbiotic relationship of the two in bionics research. Transl. by B.P.

N69-24020# Cambridge Univ. (England).
THE ASSOCIATIVE RECALL OF TEMPORAL SEQUENCES
H. C. Longuet-Higgins *In* AGARD Bionics Symp. Sep. 1968 1 p (See N69-24005 12-04)
Avail: CFSTI

A device is described for recording a number of time varying signals in such a way that input of a section of any recorded signal will cause the device to emit the continuation of that signal in real time. The name holophone is suggested for such a device. It is essentially a bank of narrow pass filters connected in parallel to an input channel and an output channel, with the special property that the gain of each filter can be increased, after the passage of a signal, by an amount proportional to the energy which it extracted from the signal. The memorization of any signal consists in altering the gains in this manner, and the memory of the system resides in the set of gain values. Author

N69-24022# Sheffield Univ. (England).
COMPUTER SIMULTATION OF SOME VISUAL FUNCTIONS
Neville Moray *In* AGARD Bionics Symp. Sep. 1968 1 p refs(See N69-24005 12-04)
Avail: CFSTI

Explanations for the appearance of visual figural after effects are suggested and described by models. A network with lateral inhibition was simulated on a computer. Several inhibitory distributions were tested, based where possible on plausible extrapolations of reports in physiological or psychological literature. Eye movements were also simulated. B.P.

N69-24024# Technische Hochschule, Karlsruhe (West Germany). Institute fuer Nachrichtenverarbeitung und Nachrichtenuebertragung.
A SPECIAL MACHINE SYSTEM FOR VISUAL PATTERN RECOGNITION
H. Kazmierczak and F. Holderman *In* AGARD Bionics Symp. Sep. 1968 1 p (See N69-24005 12-04)
Avail: CFSTI

A Karlsruhe system for image processing was developed; a brief description is given of the system including the scanner and preprocessor. The completion of the computer controlled whole system will be the basis of investigations of appropriate languages and recognition procedures for an efficient object recognition in aerial photographs. B.P.

N69-24028# Technische Univ., Berlin (West Germany).
BIOTECHNIQUE OF OSCILLATING PROPULSION SYSTEMS AND ITS INTEGRATION INTO THE BODY
Heinrich Hertel *In* AGARD Bionics Symp. Sep. 1968 1 p (See N69-24005 12-04)
Avail: CFSTI

The optimum mutual harmony of shape, structure, and movement of creatures which swim or fly at high speeds is studied in relation to applications in engineering, as for example flight bodies. The adaptive aspect of living things has resulted in models for retractable power units, among others. Detailed research was conducted on the oscillatory propulsion afforded by the tailfin of fish. The new biomechanical knowledge resulted in a novel technical system of propulsion by oscillating fins; application of this drive system is shown for ships and centrifugal pumps. B.P.

N69-24030# Air Force Systems Command, Brooks AFB, Tex. Aerospace Medical Div.
BIOELECTRO ENERGETICS: FUEL CELL ASPECT
Hubertur Strughold *In* AGARD Bionics Symp. Sep. 1968 1 p (See N69-24005 12-04)
Avail: CFSTI

The study of the biological electric phenomena offers new horizons to bioscience and bioengineering when viewed in the perspective of the recently developed fuel cells used in spacecraft. There are some interesting similarities and differences between biological organic fuel cells and the inorganic chemical fuel cells concerning structure and chemistry. This fuel cell aspect of bioelectricity might provide an inspiring stimulus for progress and knowledge of bioelectro-energetics on the one hand, and in the development of inorganic fuel cells on the other, particularly if the specific organs such as the bioelectric generators of the electric fish and electric eel and paleological evolution down to the Archeozoic Era are included. Author

N69-24033# California Univ., Berkeley.
PRINCIPLES OF NATURAL AND ARTIFICIAL INTELLIGENCE
Hans Bremermann *In* AGARD Bionics Symp. Sep. 1968 2 p refs (See N69-24005 12-04)
Avail: CFSTI

Problem solving and pattern classification techniques of machine systems are reviewed, along with the progress realized in the optimization of artificial learning systems. The use of theoretical biology in solving the challenges which remain in this field is proposed and emphasized. B.P.

N69-24035# University Coll. of North Staffordshire, Keele (England).
DIGITS AND ANALOGUES
D. M. MacKay *In* AGARD Bionics Symp. Sep. 1968 1 p refs (See N69-24005 12-04)
Avail: CFSTI

The science of artificial intelligence currently runs into trouble from two opposite quarters. On the one hand are those who make claims for computing machines; on the other are critics who seek to show that important human capacities are beyond the scope of digital machinery. Some recent attacks of the latter sort are reviewed; the suggestion is reiterated that the best kind of mechanism to meet such criticisms would combine discrete and continuous computer processes, in a manner somewhat analogous to the relation between quantal transitions and probability amplitudes in wave mechanics. Organized in hierarchic fashion, such processes would seem to have rich possibilities of reproducing spontaneously and naturally the features of behavior that are normally considered to be characteristic of human mentality. Author

N69-24098*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Project Engineering Div.
QUALITY ASSURANCE MONITORING OF THE MICROBIOLOGICAL ASPECTS OF THE STERILIZATION ASSEMBLY DEVELOPMENT LABORATORY
T. R. Gavin, G. H. Redmann, and D. M. Taylor 1 May 1969 13 p refs
(Contract NAS7-100)
(NASA-CR-100760; JPL-TR-32-1398) Copyright. Avail: CFSTI CSCL 06M

The Jet Propulsion Laboratory SADL (Sterilization Assembly Development Laboratory) program was initiated to develop and optimize the techniques, facilities, and procedures necessary for the assembly, test, microbiological monitoring, and sterilization of a capsule system which would satisfy NASA quarantine constraints with minimum effect on capsule reliability. An important aspect of SADL was the development of the Quality Assurance (QA) functions and procedures associated with the activities required for the microbiological monitoring of the capsule system, including sterility verification of material, the assay technique, certification of the facility, and the monitoring of personnel activity in the facility. The SADL QA program demonstrated that QA personnel can plan an effective role in monitoring microbiological operations by applying the same QA rationale used in their classical role in a hardware program. In particular, the application of QA methods identified the need for improvement in assay methodology and techniques as evidenced by a 0 to 30% variation in contamination of sterile samples over 16 repetitive assemblies. Author

N69-24348# Philco-Ford Corp., Blue Bell, Pa. Communications and Electronics Div.
ADAPTIVE MODELLING OF LIKELIHOOD CLASSIFICATION, SUPPLEMENT Final Report
Kenneth Abend, Thomas J. Harley, Jr., and Laveen N. Kanal Griffiss AFB, N. Y. RADC Dec. 1968 18 p refs
(Contracts AF 30(602)-3823; F33615-67-C-1636)
(AD-680468; 8008-11-Suppl-1; RADC-TR-68-118-Suppl-1) Avail: CFSTI CSCL 6/4

An attempt was made to place the relationship between recognition and classification on the one hand and between theory and application of statistical classification on the other hand, in proper perspective. Compound decision theory is the latest step in the evolution of the most general model in which to imbed statistical classification problems arising in recognition system design. For the nonformalizable aspects of design, interactive approaches, namely those in which the human is part of the loop in the design process, with different classification and heuristic algorithms at his call, seem to be most promising. Author (TAB)

N69-24349# Stanford Univ., Calif. Dept. of Computer Science.
ARTIFICIAL INTELLIGENCE: THEMES IN THE SECOND DECADE
Edward A. Feigenbaum Aug. 1968 43 p refs
(Contract ARPA SD-183; ARPA Order 457)
(AD-680487; AI-M-67) Avail: CFSTI CSCL 6/4

In this survey of artificial intelligence research, the substantive focus is heuristic programming, problem solving and closely associated learning models. The focus in time is the period 1963-1968. Brief tours are made over a variety of topics: generality, integrated robots, game playing, theorem proving, semantic information processing, etc. One program, which employs the heuristic search paradigm to generate explanatory hypotheses in the analysis of mass spectra of organic molecules, is described in some detail. The problem of representation for problem solving systems is discussed. Various centers of excellence in the artificial intelligence research area is mentioned. A bibliography of 76 references is given. Author (TAB)

N69-24463# American Inst. for Research, Pittsburgh, Pa.
INSTRUCTIONAL METHODOLOGY AND EXPERIMENTAL DESIGN FOR EVALUATING AUDIO/VIDEO SUPPORT TO UNDERGRADUATE PILOT TRAINING Technical Report, 15 Sep. 1967–1 Aug. 1968
George R. Purifoy, Jr. Oct. 1968 92 p ref
(Contract F33615-68-C-1048)
(AD-680408; AIR-728-9/68-TR; AFHRL-TR-68-5) Avail: CFSTI CSCL 5/9

This report presents a detailed description of the methods by which airborne video recording will be utilized in the training of Air Force pilots, and presents plans for an assessment of its effectiveness. Audio/video equipment configurations and limitations are discussed as they apply to training operations in the T-37 and T-38 aircraft, and training methodology is described which has been formulated to permit the integration of video recording and teaching techniques into the Air Force undergraduate pilot training program. Plans for an eight-month experimental evaluation of the effects of these techniques are detailed, including schedules, operating practices, student selection procedures, instructor training plans, data gathering processes and materials, and analysis guidelines. Author (TAB)

N69-24583# Army Nuclear Defense Lab., Edgewood Arsenal, Md.
NEUTRON SENSITIVITIES OF VARIOUS GAMMA DOSIMETERS
Max Stuetzer and Nancy N. Gibson Dec. 1968 25 p refs
(AD-682721; NDL-TM-52) Avail: CFSTI CSCL 6/18

The neutron sensitivities of silver-activated metaphosphate glass, manganese-activated calcium fluoride thermoluminescent dosimeters, and lithium fluoride thermoluminescent dosimeters have been measured for six neutron energies ranging from 1 to 14.8 MeV. Preliminary data from these experiments have been presented. Errors were introduced by the low intensities of the experimental neutron fluences and by gamma contributions to dosimeter responses. A first-order approximation of the gamma contributions was made and used to correct experimental data. The neutron sensitivities reported have been successfully applied to correct gamma-exposure data from three recent wagon effects experiments. Author (TAB)

N69-24615# Department of National Health and Welfare, Ottawa (Ontario). Radiation Protection Div.
DATA FROM RADIATION PROTECTION PROGRAMS, VOLUME 6, NUMBER 7
Jul. 1968 21 p refs
(NP-17691) Avail: AEC Depository Libraries

The report from the fallout monitoring program in Canada during June 1968 includes data on the total β activity in air filter samples and the content of ^{137}Cs and ^{90}Sr in samples of milk collected at selected locations. The results of analyses for radioactivity carried out on samples of surface water and biological materials collected in the vicinity of Canadian reactors are included. NSA

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N69-23353*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
THE SYNTHESIS OF A NOVEL POLYMIDE PRECURSOR
Peter Delvigs, Li-Chen Hsu, and Tito T. Serafini Washington Apr. 1969 16 p refs
(NASA-TN-D-5184) Avail: CFSTI CSCL 07C

A novel blocked polymide precursor was synthesized by using diethylamine as the blocking reagent. The structure of the blocked precursor is the bis(n,N-diethylamide) of the polyamic acid derived from pyromellitic dianhydride and 4,4'-diaminodiphenyl ether. The blocked precursor was more resistant to thermal imidization than the corresponding polyamic acid. The weight average, molecular weight of the blocked precursor could be increased by solid-state polymerization. However, the molecular weight of the polyamic acid could not be changed from its initial value. Furthermore, the blocked precursor was still completely soluble after solid-state polymerization. The solvolytic stability of the blocked precursor in anhydrous N,N-dimethylacetamide was superior to that of the polyamic acid. Author

N69-23362 Delaware Univ., Newark.
PULSE RADIOLYSIS STUDIES
Nathan Klein (Ph.D. Thesis) 1967 88 p
Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-13160

An investigation of chemical reactions taking place in aqueous solutions during and immediately after an X-radiation pulse was carried out. The objectives of this investigation were first, to determine whether there existed a measurable period during which transient species, produced by the radiation, were inhomogeneously distributed in solution and, second, to shed light on the nature of the primary radiolytic species produced in aqueous solution by ionizing radiation. The techniques of kinetic spectroscopy were used to achieve these goals. Equipment was assembled that is capable of measuring optical absorption as a function of time using 6328 Å light. The resolving time of this equipment is in the nanosecond range. Dissert. Abstr.

N69-23428# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
COMPOSITION AND STRUCTURE OF AMMONIUM URANATES
W. I. Stuart and T. L. Whateley Oct. 1968 19 p refs
(AAEC/EI94) Avail: CFSTI

The ammonium uranate system was studied by thermal analysis, ion exchange measurements and infrared spectroscopy. The results show that in all ammonium uranates, ammonia is combined as NH_4^+. Infrared results indicate that the ammonium uranate system is singlephase in which the NH_3:U ratio can be varied continuously. In an aqueous environment the variation of composition occurs by a cation exchange mechanism. Author

N69-23432 Delaware Univ., Newark.
ELECTRON SPIN RESONANCE INVESTIGATIONS IN PHOTOEXCITED ZINC SULFIDE PHOSPHORS
Harry D. Fair, Jr. (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-13154

Combined optical irradiation and electron spin resonance studies were performed on zinc sulfide powders and single crystals doped with the impurities copper, gallium, and chromium. The zinc sulfide–chromium system was investigated to determine the valence state and energy level configurations for the chromium impurity. The spectral response of the chromium spin resonance was used as a probe to identify non-paramagnetic energy levels in systems containing impurities in addition to chromium. The zinc sulfide–gallium, chromium system was investigated to determine the energy levels of the A-center impurities and to study the electronic processes responsible for the blue self-activated luminescence in this material. A photoexcited electron spin resonance was observed in impurity compensated zinc sulfide–copper, gallium at 77°K and 4.2°K. Dissert. Abstr.

N69-23434*# Notre Dame Univ., Ind. Dept. of Chemistry.
SYNTHESIS OF POLYMERS WITH HIGH RESIDUES AT HIGH TEMPERATURES Yearly Summary Report, 1 Feb. 1968–31 Jan. 1969
G. F. D'Alelio Feb. 1969 6 p refs
(Grant NGR-15-004-028)
(NASA-CR-100681) Avail: CFSTI CSCL 07B

Publications concerning research carried out from February, 1968, through January, 1969, are listed. The status of other activities is reported, including studies on polymerization reactions of azomethines and on crosslinked polyimides. P.A.B.

N69-23441*# Stanford Research Inst., Menlo Park, Calif.
BINDER MODEL SYSTEM TO BE USED FOR DETERMINATION OF PREPOLYMER FUNCTIONALITY Quarterly Report, 19 Nov. 1968–19 Feb. 1969
J. H. Hodgkin, F. J. Martinelli, and J. Heller 24 Mar. 1969 29 p refs Prepared for JPL
(Contract NAS7-689; SRI Proj. PRU (7471)
(NASA-CR-100680; QR-2) Avail: CFSTI CSCL 07C

The recording viscometer method, developed previously, was further improved and modified. The method was applied to the reactions of model compounds, and the results obtained correspond closely with the expected values. Preliminary tests were also carried out on a number of carboxy- and hydroxy-terminated prepolymers. The results indicate that the recording viscometer technique can be used to determine the functionality of most prepolymers, including unsaturated ones. Author

N69-23445# Bureau of Mines, Pittsburgh, Pa.
CALCULATING EQUILIBRIUM COMPOSITIONS OF MULTICONSTITUENT, MULTIPHASE, CHEMICAL REACTING SYSTEMS
H. F. Feldmann, W. H. Simons, and D. Bienstock May 1969 25 p refs
(BM-RI-7257) Avail: Issuing Activity

A method is presented for the computer solution of the equilibrium compositions of any complex, multiphase, chemical system for which appropriate thermodynamic data are available. The method describes in detail the computation of systems in which solid or liquid species can form by heterogeneous chemical reactions where these species do not occur in any equilibrium equations. Also described are the calculation of phases formed by condensation (pure or solutions) and the inclusion of other system restrictions such as electroneutrality. The method is being used to compute the equilibrium composition of mixtures of an electrically conductive plasma and a liquid slag phase arising from the high-temperature combustion of coal for magnetohydrodynamic power generation. These mixtures can contain up to 65 species including gases, liquids, free electrons, and ions. Author

N69-23457 State Univ. of Iowa, Iowa City.
STUDIES IN STEREOCHEMISTRY
Donald Charles Best (Ph.D. Thesis) 1968 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-14773

Conformational preferences of acyclic diastereomers and the substituent effect on a reaction involving suspected phenonium ion intermediates are studied. The conformational preferences of several erythro-threo pairs of diastereomers were investigated using nmr and dipole moment techniques. The syntheses and separations of the diastereomers are reported. The reactions of various p,p' substituted 1,2-diphenyl 1-propanols with hydrohalic acids were investigated, and the stereoselectivity of the reactions were correlated with the electron donating ability of the p,p' substitutents. Dissert. Abstr.

N69-23462 Rensselaer Polytechnic Inst., Troy, N. Y.
LIGAND BRIDGING IN ELECTRODE REACTIONS: THE OXIDATION/REDUCTION OF COBALT/ EDTA COMPLEXES
George Craig Grant (Ph.D. Thesis) 1968 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-13513

Strong evidence was presented to show that halide ion does not function as a ligand bridge in the electrooxidation of Co(II)-EDTA at either a platinum or a mercury electrode, although there are many chemical similarities between the two systems. The character of the electrode surface was shown not responsible for the differences in the effect of halide ions for these two reactions. Several chemical species which cause interference with determination of the electrode reaction mechanisms were investigated. It was demonstrated that presence of certain Hg(II) species in the working electrode compartment leads to strong interference, while certain platinum compounds, if present at the electrode surface, leads to moderate interference. Dissert. Abstr.

N69-23477 Oklahoma Univ., Norman.
SEPARATE FORMATION ENERGIES OF POSITIVE AND NEGATIVE ION VACANCIES IN LITHIUM FLUORIDE
Oliver Sanders Spencer (Ph.D. Thesis) 1968 94 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-14209

Dislocations in ionic crystals should possess a charge having a temperature dependent magnitude, whose sign is governed by the divalent ion impurity content and the cation vacancy formation energy. At the isoelectric temperature T_c the dislocation charge vanishes. From simultaneous knowledge of the cation vacancy concentration C and T_c, the cation vacancy formation energy g_+ can be calculated using a simple theory. Using the method of Davidge, we have experimentally determined T_c and C for LiF. Further, we tested NaCl samples using the same method, and find good agreement with the literature for the values obtained for T_c. Dissert. Abstr.

N69-23491# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

EQUILIBRIUM GAS-PHASE COMPOSITIONS OF ETHANE AND ETHYLENE IN BINARY MIXTURES WITH HELIUM AND NEON BELOW 150K AND A CORRELATION FOR DEVIATIONS FROM THE GEOMETRIC MEAN COMBINING RULE

W. J. Hiza and A. G. Duncan [1968] 40 p *refs* Presented at the Cryog. Eng. Conf., Case Western Reserve Univ., Cleveland, 19-21 Aug. 1968 */ts* Paper no. B-1

Avail: Issuing Activity

Equilibrium gas-phase compositions in the systems helium-ethane and helium-ethylene were measured along six and seven isotherms, respectively, between 90° and 150°K up to 130 atm pressure. Corresponding measurements were made in the systems neon-ethane and neon-ethylene along two isotherms each, but only up to 50 atm pressure. A single-pass flow apparatus was used with continuous analysis for ethane or ethylene by means of a hydrogen flame-ionization detector. These data complete a set of nine binary systems containing hydrogen, helium, and neon, with light hydrocarbons which are the basis of a correlation relating the deviations from the geometric mean combining rule for the characteristic energy parameter to the ionization potentials of the component species. Author

N69-23497 California Univ., Los Angeles.

METAL DISSOLUTION OF FLOWING AQUEOUS ELECTROLYTES AT HIGH CURRENT DENSITIES

Joram Hopenfeld (Ph.D. Thesis) 1968 158 p

Avail: Univ Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-14542

An analytical and experimental study is presented describing the relation between various process variables when metal is dissolving in flowing aqueous electrolytes at high current densities (50-400 amp/in^2). Employing the basic conservation laws, a system of coupled nonlinear differential equations is derived for the gas-electrolyte mixture which occupies the space between the electrodes. These equations are numerically solved on a digital computer to predict the variation in gap along the flow passage and its dependence of the current on the applied voltage. Results of the theoretical predictions compare well with the experimental data. An approximate expression which correlates the process variables in closed form is also presented. Dissert. Abstr.

N69-23504# Commissariat a l'Energie Atomique, Pierrelatte (France).

TUNGSTEN HEXAFLUORIDE (WF_6) [L'HEXAFLUORURE DE TUNGSTENE WF_6]

Maurice Carles Sept. 1968 30 p *refs* In FRENCH

(CEA-Bib-125) Avail: AEC Depository Libraries

WF_6 is generally prepared either from tungsten hexachloride and hydrofluoric acid used as a reactant or by direct synthesis of its components. It appears as a colorless gas ten times denser than the air. Solid tungsten hexafluoride is a white body which melts around −0.4°C and boils around 17°C under air pressure. Symmetrical in structure, the molecule consists of one metal atom in the center of an octahedron the apexes of which are occupied by fluorine atoms. Highly reacting, tungsten hexafluoride fumes in the air and corrodes practically all metals except gold and platinum. It forms addition compounds with sodium, potassium, rubidium, cesium, manganese, and ammonium fluorides and also with some nitrogen compounds like nitrile and nitrosyl fluorides and N_2O_4 oxide. It can be reduced by many compounds such as HCl, HBr, HI, and CO to give subfluorides. Metal tungsten hexafluoride is obtained with high temperature hydrogen. This reaction is often used to obtain deposit films or to make tungsten objects. Author (NSA)

N69-23508# Commissariat a l'Energie Atomique, Pierrelatte (France).

MOLYBDENUM HEXAFLUORIDE (MoF_6) [L'HEXAFLUORURE DE MOLYBDENE MoF_6]

Maurice Carles Sep. 1968 27 p In FRENCH

(CEA-Bib-124) Avail: AEC Depository Libraries

MoF_6 is ganarally prepared by direct synthesis of its components. The molecule is entirely symmetrical in structure; the metal atom is located in the center of an octahedron, the apexes of which are occupied by fluorine atoms. When cold, this compound appears as a crystallized white solid body. It melts around 17.5°C and boils around 35°C under air pressure. Very sensitive to hydrolysis and reduction, molybdenum hexafluoride forms addition compounds with sodium, potassium, rubidium, and cesium fluorides. It also forms complex compounds with nitrile and nitrosyl fluorides and nitrogen oxides. The reactivity of this symmetrical molecule shows the nonsaturation properties of molybdenum regarding coordination. Inversely, the high inertia of sulfur and selenium hexafluoride molecules, which are similar, is to be noted. Author (NSA)

N69-23510# Kansas Univ., Lawrence. Dept. of Chemistry.

[WORK UNDERTAKEN] Progress Report, 1 Nov. 1967-31 Oct. 1968

Paul W. Gilles 31 Oct. 1968 26 p

(Contract AT(11-1)-1140)

(COO-1140-174) Avail: CFSTI

Research is being carried out on the chemistry of the titanium-oxygen system, the properties of borides, the chemistry of high-molecular-weight boron sulfides, and chemical transport reactions. NSA

N69-23542 California Inst. of Tech., Pasadena.

COMPLICATIONS IN THE SYSTEMATIC STUDY OF PHOTOCHEMICAL MECHANISMS

George Francis Vesley, Jr. (Ph.D. Thesis) 1968 163 p

Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-12766

The rate constants for energy transfer have been measured by flash spectroscopic techniques. These results show that 1,3-cyclohexadiene undergoes a nonvertical transition when low energy sensitizers are used. The quantum yields for the high energy sensitized dimerization 1,3-cyclohexadiene are consistent with the simple mechanism proposed. The use of 1,2-benzanthracene, a low energy sensitizer, to sensitize the dimerization of 1,3-cyclohexadiene has been studied in detail. The results show that in addition to energy transfer from donor to acceptor, other steps such as reversible energy transfer, adduct formation, singlet quenching of aromatic hydrocarbons by dienes and sensitizer-sensitizer interactions are important. Dissert. Abstr.

N69-23545 Rensselaer Polytechnic Inst., Troy, N. Y.
A STUDY OF THE PRESSURE BROADENING EFFECTS OF FOREIGN GASES ON THE ν_3 BAND OF THE VIBRATION-ROTATION SPECTRUM OF METHANE
Philip Joseph Baldacchino (Ph.D. Thesis) 1968 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-13503

The ν_3 band in the vibration-rotation spectrum of methane was obtained for pure methane and for methane broadened with helium and nitrogen, respectively, using a Perkin-Elmer Model 421 Spectrophotometer. Measurements were made of the peak heights and Lorentzian half-widths of the R-1 to R-18 and P-3 to P-13 subbands. Computer programs were developed which used these parameters in the Lorentzian line shape equation and Simpsin's rule to extrapolate these subbands back to 0.00 absorbance base line and to calculate the area of each of these peaks. Values were also obtained for the foreign-gas broadening coefficient of helium relative to nitrogen and for the relative optical collision diameter of methane-helium to methane-nitrogen for the subbands R-1 to R-14 and P-3 to P-10. Dissert. Abstr.

N69-23546 St. Louis Univ., Mo.
HIGH TEMPERATURE VISCOSITIES OF POLAR GAS MIXTURES: AMMONIA AND METHYLAMINE
Lawrence Gordon Burch (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-14061

The viscosities of ammonia, monomethylamine, and mixtures of these polar gases have been determined at moderately high temperatures, ranging from 0°C to about 400°C. The viscosities were determined in a constant volume viscometer by a relative method. Nitrogen, whose viscosity is known, was used to calibrate the viscometer. The viscosities of ammonia, methylamine, and the mixtures were then obtained using Poiseuille's equation. Dissert. Abstr.

N69-23548 State Univ. of Iowa, Iowa City.
FIELD EMISSION AND FLASH FILAMENT STUDIES OF HYDROGENATION AND DEHYDROGENATION OF CYCLOHEXENE AND BENZENE ON A TUNGSTEN SURFACE
James Benton Condon (Ph.D. Thesis) 1968 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-14781

The hydrogenation and decomposition of benzene and the hydrogenation and disproportionation of cyclohexene on a tungsten surface were investigated with the aid of field emission microscopy and flash filament mass spectrometry. Dissert. Abstr.

N69-23560# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Research.
SUMMARIES OF THE USAEC BASIC RESEARCH PROGRAM IN CHEMISTRY (OFF SITE)
Jan. 1969 122 p *Its* Ed. 1
(TID-4051) Avail: CFSTI

Summaries of current projects being supported by the Office of Chemistry Programs of the Division of Research under its offsite program are reported. This includes the objectives and current status of the individual research efforts in effect on June 30, 1968. The contract summaries are arranged with cross-referencing in the following chemistry subdiscipline categories: heavy element; nuclear; hot atom; radiation; structural and theoretical; isotope effects; high-temperature; inorganic; physical; analytical; geochemistry; and nuclear engineering and separations chemistry. Each summary includes the name and address of the principal investigator, the date on which the summary was received, the AEC contract number, and usually a list of publications in the open literature resulting from the research within the past year. Principal investigator, corporate author, and subject indexes are included. NSA

N69-23570 North Carolina State Univ., Raleigh.
HIGH RESOLUTION NUCLEAR MAGNETIC RESONANCE OF POLYCYCLIC AROMATIC HYDROCARBONS AND AROMATIC HETEROCYCLIC COMPOUNDS
Thomas Berry Cobb (Ph.D. Thesis) 1968 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-14648

The McWeeny theory has been used to calculate chemical shielding parameters for all even, alternant, pentacyclic hydrocarbons, and comparison with experiment was made where data were available. The spectra of two pentacyclic molecules, 1,2,3,4-dibenzanthracene and picene were obtained and analyzed, and a complete analysis of the 1,2-benzpyrene spectrum is given. Agreement between theory and experiment is satisfactory for protons not subject to large van der Waals contact, and it is found that steric effects contribute an extra downfield shift of 0.54 ppm to angular phenanthrenic type protons. The π-electron charge densities were calculated for a series of nitrogen heterocyclics. It was found that for all molecules in which there were not two *N*-atoms adjacent in the same ring a good linear correlation exists between the electron densities and chemical shifts for protons situated ortho to the substituted *N*-atoms. The results indicate that mechanisms other than charge densities must be considered in order to predict accurately the effect of heteroatom substitutions in aromatic systems. Dissert. Abstr.

N69-23580 University of Southern Calif., Los Angeles.
THE FLASH PHOTOLYSIS OF TRANSITION METAL COORDINATION COMPOUNDS CONTAINING HALIDE OR PSEUDOHALIDE LIGANDS
Paul Dell Fleischauer (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-13576

The photochemistries of the following coordination complexes have been studied with the emphasis being on the study of very rapid reactions using the technique of flash photolysis: $K_2[PtBr_6]$, $[Pt(NH_3)_4Br_2]$ $(ClO_4)_2$, $[Pt(NH_3)_4(SCN)_2]$ $(ClO_4)_2$, $K_3[Cr(CN)_6]$, and $K_3[Cr(NCS)_6]$. With the exception of $K_2[PtBr_6]$ all of these complexes yield the respective halide or pseudohalide dianions when flashed under appropriate conditions. These species were identified from their spectra and decay kinetics. Dissert. Abstr.

N69-23582# Mississippi Univ., University. Dept. of Chemistry.
INVESTIGATION OF GAMMA-RAY INDUCED POLYMER FORMATION IN THE CARBORANES Annual Progress Report
Theodore J. Klingen 1 Dec. 1968 9 p
(Contract AT(40-1)-3781)
(ORO-3781-2) Avail: CFSTI

Polymeric products were not obtained in the γ-radiolysis of solid o-carborane and o-carborane in benzene solution. Properties of the product formed in the γ-radioinduced polymerization of vinyl-o-carborane are reported. NSA

N69-23593*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCESSING SPECTROPHOTOMETRIC MEASUREMENTS TO COMPUTE CHEMICAL REACTION RATES AND CORRELATE THEM TO A RATE EQUATION: A COMPUTER PROGRAM

Robert A. Rhein 15 Apr. 1969 24 p refs
(Contract NAS7-100)
(NASA-CR-100672; JPL-TR-32-1384) Copyright. Avail: CFSTI
CSCL 07D

Program RTPROG, along with subroutines RATECL and MREG, was designed for processing spectrophotometric transmittance data for the computation of bimolecular initial reaction rates, and the correlation of these rates to expressions of the form of either $Rate = k \cdot C^{a}_{A} \cdot C^{b}_{B}$ or $Rate = k \cdot C^{a}_{A} \cdot C^{b}_{B} \cdot e^{-E/n}$. Computer output from data processed by this program include the constants K, a, b (and, where applicable, E), as well as the printout of concentration vs time, the initial reaction rates, and other data in a format that can be readily used for future reference. This program directs the printing of detailed instructions to the operator, showing which data are to be fed to the computer and what format is to be followed. By using this program, the experimenter can save the time normally required to process experimental data.
Author

N69-23597# Mound Lab., Miamisburg, Ohio.
MOUND LABORATORY CHEMISTRY AND PHYSICS Progress Report, April–June 1968
16 Dec. 1968 69 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1520) Avail: CFSTI

Research progress is reported on: the alpha–beta branching ratio of ^{227}Ac, praseodymium compound preparation, actinide dibenzoylmethane complexes, residue absorption, ^{234}U recovery, ^{229}Th recovery, ^{206}Pb recovery, decay scheme of ^{210m}Bi, resonant states of doubly closed shell plus one neutron nuclei, fast neutron spectroscopy, pulse-height analysis of radioactive gases, thin-crystal counting of ^{238}Pu in process solutions, determination of coincidence corrections, half-life determination of decaying pairs, and a high-wattage flow calorimeter.
NSA

N69-23606 Hawaii Univ., Honolulu.
SELECTED TRACE ELEMENTS IN HAWAIIAN LAVAS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
Edward Herlicska (Ph.D. Thesis) 1967 269 p
Avail: Univ. Microfilms: HC $12.15/Microfilm $3.50 Order No. 68-11930

A versatile atomic-absorption spectrophotometer has been designed and constructed for an investigation of trace elements in rocks. About 80 samples of Hawaiian lavas have been analyzed for Cu, Zn, Ni and Cr. Most of the results indicate a continuous fractionation and are well in agreement with the few literature values available. Data was subjected to mathematical analysis to examine relationships among the various major and minor elements. Further interpretations were made using a crystal field theory approach. The results of this research indicate the continued need for trace element distribution determinations in bulk rocks and in minerals so that eventually the chemical system might be better defined and subjected to continued mathematical and physical scrutiny.
Dissert. Abstr.

N69-23607 University of the Pacific, Stockton, Calif.
A REVERSED-PHASE THIN LAYER CHROMATOGRAPHIC SEPARATION OF THE LIGHT RARE EARTHS WITH A SPECTROPHOTOMETRIC DETERMINATION
Leslie Arthur Whitaker (Ph.D. Thesis) 1967 120 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-13595

In this study, two, three, four, five, and six rare earths were separated via reversed-phase thin layer chromatography. Selected sample spots were removed from the plate and determined by emission spectroscopy. Di-(2-ethylhexyl) phosphoric acid was used as the stationary phase. This organic substituted inorganic acid is retained on the adsorbent through hydrogen bonding and is essentially hydrophobic, so that the aqueous mobile phase can pass over it without serious interaction between the two acids. Silica Gel HR, Silica Gel N, and MN-Cellulose 300 were selected and used as the adsorbents to retain the HDEHP for the separations. The most effective separations were found to take place on the cellulose.
Dissert. Abstr.

N69-23616# Brookhaven National Lab., Upton, N. Y.
STUDY OF REACTIONS BETWEEN OXYGEN AND IMPURITIES IN SODIUM
H. S. Isaacs, B. Minushkin, and F. J. Salzano 27 Nov. 1968 17 p refs Presented at the Conf. on Sodium Technol. and Large Fast Reactor Design, Argonne, Ill.
(BNL-13114; CONF-681106-7) Avail: CFSTI

Reactions were found to occur between the components of stainless steel and oxygen in sodium. These reactions can act to buffer the oxygen activity in the system. At 500°C it is probable that chromium is one of the metals that react with oxygen. The buffering action suggests that the reaction involves an equilibrium between a reduced and oxidized chromium–oxygen compound and that two solid phases are present in the system. The equilibrium oxygen concentration for this reaction at 500°C is tentatively set at 17 ppM. Above this concentration chromium can getter oxygen from sodium, and below this concentration the oxidized specie can supply oxygen to the system.
Author (NSA)

N69-23617# Brandeis Univ., Waltham, Mass. Dept. of Chemistry
EFFECTS OF MERCAPTANS AND DISULFIDES ON PHOTOCHEMICAL AND HIGH ENERGY RADIATION INDUCED REACTIONS Progress Report
Saul G. Cohen 1 Nov. 1968 25 p
(Contract AT(30-1)-2499)
(NYO-2499-26) Avail: CFSTI

Photoreduction of aromatic ketones by primary, secondary, and tertiary amines in aqueous-organic media was studied. Studies on the photoreduction of aminobenzophenones by organic reducing agents, particularly tertiary amines in nonpolar media, were continued. Additional work was done on the photochemistry of the acetone benzhydrol 2-mercaptomesitylene system. Effects of mercaptans on irradiation of dilute aqueous solution of organic compounds are reported. The γ-radioinduced conversion of aqueous 2-propanol to acetone was found to be retarded by aliphatic mercaptans, while the conversion of aqueous acetone to 2-propanol was accelerated by mercaptans.

N69-23618 Auburn Univ., Ala.
OXIDATION KINETICS BASED ON IONIC DIFFUSION IN DISCRETE LATTICES
Earl Lewis Cook, III (Ph.D. Thesis) 1968 254 p
Avail: Univ. Microfilms: HC $11.50/Microfilm $3.30 Order No. 68-13494

A theoretical and numerical study of several models for the thermal oxidation of metals is presented. Fromhold's coupled current approach is utilized with diffusion in discrete lattices assumed for the ionic transport and thermal emission and quantum mechanical tunneling assumed for the electronic transport. The derivation of the field-assisted diffusion equation is presented with special consideration given to lattice discreteness. The more general case of diffusion in the presence of space charge is considered, but the complexities of this case prevent a complete analytical solution. The treatment presented does appreciably reduce the complexity of the problem and yields a formulation amenable to numerical investigation. The electron thermal emission and

electron tunneling transport mechanisms are carefully examined and the equations appropriate to the metal-oxide-oxygen system are derived and discussed. Dissert. Abstr.

N69-23624# Oak Ridge National Lab., Tenn. Chemistry Div.
X-RAY DIFFRACTION DATA ON THE SYSTEM TETRA n-BUTYL AMMONIUM FLUORIDE–WATER AT 25°C
A. H. Narten Dec. 1968 49 p refs
(Contract W-7405-eng-26)
(ORNL-4333) Avail: CFSTI

The scattering of X-rays from a saturated solution of tetra n butylammonium fluoride in water was measured and analyzed at 25°C. Intensity and radial distribution functions, calculated for two different models, are compared to those derived from the diffraction data. The respective models assume modified ice and gas hydrate structures, surrounded by a random distance distribution, as an adequate description for the average short-range order in the solution. The ice model explains the X-ray data of the solution and of pure water, while the gas hydrate model is shown to be incompatible with the experimental radial distribution function of liquid water. The raw data, the reduced intensity and radial distribution functions derived from them, and the least-squares refined parameters of the two models for the liquid solution are presented in tabulated form. Author (NSA)

N69-23659# Israel Program for Scientific Translations, Ltd., Jerusalem.
PHYSICOCHEMICAL PRINCIPLES OF GLUING AND ADHESION PROCESSES
N. I. Moskvitin 1969 194 p refs Transl. into ENGLISH of the book "Fiziko-Khimicheskie Osnovy Protessov Skleivaniya i Prilipaniya" Moscow, izd. Lesnaya Prom., 1964 Published for Dept. of Agr. and NSF Its Cat. No. 5260
(TT-68-50368) Copyright. Avail: CFSTI

CONTENTS:

1. METHODS FOR THE DETERMINATION OF ADHESION, AUTOHESION, AND COHESION p 3–38 (See N69-23660 12-06)
2. THEORY OF ADHESION p 39–103 (See N69-23661 12-06)
3. ADHESION AND AUTOHESION OF HIGH-POLYMER FIBERS IN AQUEOUS MEDIA p 104–124 (See N69-23662 12-06)
4. ADHESION OF BEATEN FIBERS p 125–150 (See N69-23663 12-06)
5. SIZING OF FIBER SUSPENSIONS WITH HYDROPHOBIC MATERIALS p 151–185 (See N69-23664 12-06)

N69-23660# Israel Program for Scientific Translations, Ltd., Jerusalem.
METHODS FOR THE DETERMINATION OF ADHESION, AUTOHESION AND COHESION
In its Physicochem. Principles of Gluing and Adhesion Processes 1969 p 3–38 (See N69-23659 12-06)
Copyright. Avail: CFSTI

The three principal factors which affect the strength of materials composed of wood fibers, wood shavings or other wood particles bound to each other by use of an adhesive substance are defined as adhesion, autohesion, and cohesion. Various methods are classified as to criteria by which they determine the forces and energies of adhesion and cohesion. Particular emphasis is placed on the following techniques and instrumentation: (1) dynamometric determination of bonding forces; (2) determination of adhesion and cohesion with adhesiometers' including a discussion of the operating principles of the rotating strip adhesiometer; (3) adhesiograms and their interpretation; (4) determination of adhesive energy by crossed thread techniques; and (5) methods of determining adhesion under equilibrium conditions. A.C.R.

N69-23661# Israel Program for Scientific Translations, Ltd., Jerusalem.
THEORY OF ADHESION
In its Physicochem. Principles of Gluing and Adhesion Processes 1969 p 39–103 (See N69-23659 12-06)
Copyright. Avail: CFSTI

Appropriate models are constructed for: (1) contact of two like or unlike solid substances; (2) solid-liquid adhesion; (3) adhesion produced from chemical bonds, which are much stronger than intermolecular bonds; and (4) adhesive contact between two high polymeric materials. Various theories of adhesion and cohesion of materials, including the mechanical, adsorption, diffusion, electrical, and electrorelaxational theories, are described as related to the formation of bonds and their resistance to separation. Finally, bond separation is analyzed in order to determine whether or not the separation process represents the least resistance of the system and if it is possible to find the weakest surface from the observed type of failure. A.C.R.

N69-23662# Israel Program for Scientific Translations, Ltd., Jerusalem.
ADHESION AND AUTOHESION OF HIGH-POLYMER FIBERS IN AQUEOUS MEDIA
In its Physicochem. Principles of Gluing and Adhesion Processes 1969 p 104–124 (See N69-23659 12-06)
Copyright. Avail: CFSTI

The adhesion of polymers threads in water and in electrolytic solutions was investigated in order to verify the difference in behavior of hydrophilic surfaces in aqueous media with that of lyophilic bodies, such as quartz, which had been previously determined. Particular emphasis was placed on cellulose threads in order to use the results to clarify a number of controversies in the industrial production of heterogeneous fiber materials; to provide a better theoretical basis for these processes; and to indicate improved time and temperature parameters in the manufacturing of paper, fiber boards, cardboards, artificial leather, etc. Experiments were conducted on cellulose hydrate, acetylcellulose, and nitrocellulose, which have a similar structure, but differ in hydrophilic properties and have different functional groups. A.C.R.

N69-23663# Israel Program for Scientific Translations, Ltd., Jerusalem.
ADHESION OF BEATEN FIBERS
In its Physicochem. Principles of Gluing and Adhesion Processes 1969 p 125–150 (See N69-23659 12-06)
Copyright. Avail: CFSTI

The two desired results from beating, by which most of the physical properties of fibrous materials are determined, are treated: (1) shortening of fibers, a relatively simple process; (2) splitting of fibers to ensure the longitudinal separation into fibrils and fine fibers, the most important prerequisite for satisfactory matting of fibers during sheet formation. The effect of moisture and heat on the adhesion and cohesion of structural elements of wood is also analyzed. Finally, methods of determining the adhesive capacity of beaten stock, as well as the closely related absorptive capacity of fiber stock, are described, and the effect of fiber adhesion on the properties of finished products is discussed. A.C.R.

N69-23684# Israel Program for Scientific Translations, Ltd., Jerusalem.
SIZING OF FIBER SUSPENSIONS WITH HYDROPHOBIC MATERIALS
In its Physicochem. Principles of Gluing and Adhesion Processes 1969 p 151–185 (See N69-23659 12-06)
Copyright. Avail: CFSTI

The purpose of sizing fiber based articles, so as to improve their resistance to water; the methods of accomplishing this objective; and the resultant absorbent characteristics of various finished products are discussed. Formulas are derived for establishing the tensile strength of such products as a function of varied parameters. The complex process of sizing fiber stock in an aqueous medium is described, and it is emphasized that the sizing effect is primarily determined by heterocoagulation and homocoagulation. The process involved two stages: (1) blending the fiber suspension with the sizing agent; and (2) deposition of the size on the fiber (coagulation). Parameters affecting the quality of both sizing stages are discussed in detail. A.C.R.

N69-23680# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
PURIFICATION OF SODIUM BY OXIDE DIFFUSION ALONG AN INDUCED CONCENTRATION GRADIENT
A. R. Pugh Oct. 1968 21 p refs
(RD/B/N-1182) Avail: CFSTI

By applying a temperature gradient to a static sodium column a concentration gradient of oxide in solution is induced. A pool of sodium of low oxygen content is obtained at the hot end of the gradient by trapping out the diffusing oxide at the cold end. The theory for the rate of removal of oxide and the ultimate purity of the sodium pool is given for two different applied temperature gradients. The design and performance of a laboratory scale apparatus is discussed. Author (NSA)

N69-23689# Oak Ridge National Lab., Tenn.
SOLUBILITY OF CESIUM TRIFLUORIDE IN MOLTEN MIXTURES OF LiF, BeF_2 AND ThF_4
Judy A. Fredricksen, L. O. Gilpatrick, and C. J. Barton Jan. 1969 25 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2335) Avail: CFSTI

The solubility of CeF_3 was determined at various temperatures in six mixtures of LiF, BeF_2, and ThF_4 of the type that may be used to fuel a molten salt breeder reactor. Comparison of earlier data on the solubility of PuF_3 and CeF_3 in fluoride solvents makes it possible to predict that the solubility of PuF_3 in single-region fuel compositions at reactor operating temperatures will be more than adequate. The solubility data as a function of solvent composition were best correlated by a model that assumes BeF_2 to be complexed as the BeF_4^{2-} ion and ThF_4 as the ThF_5^{1-} ion. Author (NSA)

N69-23708*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
DETERMINATION OF OXYGEN IN LITHIUM BY THE VACUUM DISTILLATION METHOD
Randall F. Gahn Washington May 1969 13 p refs
(NASA-TN-D-5197) Avail: CFSTI CSCL 07B

The vacuum distillation method for determining oxygen in alkali metals was applied to lithium. In this method the nonvolatile impurities, assumed to be lithium monoxide, are separated from the volatile lithium by heating the lithium sample in high vacuum. The alkalinity of the lithium content of the impurities is then converted to an oxygen concentration. Method reproducibility was determined at the 30 and 80 ppm oxygen levels. Method accuracy was evaluated through quantitative oxygen additions and recoveries, estimation of the method blank, and characterization of the distillation residue from the lithium-oxygen system. Author

N69-23736 Missouri Univ., Rolla.
AN EXPERIMENTAL DETERMINATION OF THE HOMOGENEOUS NUCLEATION RATE OF WATER VAPOR IN ARGON AND HELIUM
Louis Benton Allen, Jr. (Ph.D. Thesis) 1968 211 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-14690

An expansion type cloud chamber was used to measure the nucleation rate of water vapor in an atmosphere of helium and argon. A careful study was made of the thermodynamic characteristics during the expansion so that the nucleation data could be interpreted with reasonable accuracy and consistency. A fine wire thermocouple was used to measure the gas temperature during the course of an isentropic expansion in the dry chamber. When the finite heat capacity of the thermocouple is accounted for, it is found that there is almost perfect agreement with the temperature calculated from the equation of state and the pressure measurement. This establishes the expansion cloud chamber as the instrument with the most accurately known thermodynamic characteristics and the one where the supersaturation may be calculated with the greatest precision. The homogeneous nucleation rate of water vapor in a helium atmosphere was measured as a function of temperature, supersaturation and sensitive time. Dissert. Abstr.

N69-23739# Technische Hogeschool, Eindhofen (Netherlands).
THE MECHANISM OF THE FORMATION OF THE PEROXODISULPHATE ION ON A PLATINUM ANODE [HET MECHANISME VAN DE VORMING VAN HET PEROXODISULFAAT ION AAN EEN PLATINA ANODE]
Willem Smit (Ph.D. Thesis) 1969 233 p refs In DUTCH; ENGLISH summary
Avail: CFSTI

The mechanism of peroxodisulfate formation on platinum anodes was investigated by determining current efficiencies and potentials at constant temperature and at various constant current densities in dependence on the concentration of the sulfur containing species in the electrolyte. Raman spectra of a sulfuric acid and ammoniumhydrogensulfate solution were correlated with measured current efficiencies after the anode potential had reached a steady value. It was found that only the SO_4 ions are involved in the persulfate layer formation. In the sequence from Li to Cs, the adsorption of SO_4 and the rate of discharge $SO_4 = \rightarrow e \rightarrow SO_4$ was enhanced while the rate of the oxygen evolution reaction in itself slowed down. Author

N69-23772# Los Alamos Scientific Lab., N. Mex.
MECHANISM OF CATALYTIC POLYMERIZATION AND COPOLYMERIZATION OF LOWER ALKYLUINXL ETHERS (R EQUALS METHYL THROUGH BUTYL): A BIBLIOGRAPHY
Jean Furnish, comp. 20 Mar. 1968 21 p refs
(Contract W-7405-eng-36)
(LA-3940) Avail: CFSTI

A search of Chemical Abstracts, Vol. 44 (1950) to Vol 68, No. 10 (March 4, 1968), was made for information on mechanisms of catalytic polymerization of lower alkyl vinyl ethers. Entries in the bibliography, containing 207 references, are arranged in order of date of publication with the most recent given first, then alphabetically by author. An author index is included. NSA

N69-23838# Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.

HIGH PURITY NIOBIUM THROUGH ALUMINOTHERMIC REDUCTION OF NIOBIUM PENTOXIDE

C. K. Gupta and P. K. Jena 1968 12 p refs

(BARC-328) Avail: CFSTI

Massive niobium metal has been obtained by aluminothermic reduction of Nb_2O_5 in a closed magnesia lined mild steel vessel. The reaction was initiated by external heating of the bomb at a relatively low temperature of about 450°C using a small amount of the trigger mixture of calcium and sulphur. The niobium metal button yield cleanly separated from the slag, was about 88 pct. using 100 g of the oxide per run. The as-reduced metal obtained with stoichiometric amount of the reductant was found to contain 2.82 pct. of Al and was very brittle. The removal of aluminum and other impurities from the reduced metal have been successfully achieved by non-consumable arc melting in argon atmosphere and electron-beam refining without much loss in niobium value. Author

N69-23840# Bhabha Atomic Research Centre, Bombay (India). Analytical Div.

DETERMINATION OF OXYGEN IN SODIUM

N. P. Bhat, K. A. Khasgiwale, and M. Sundaresan 1968 20 p refs

(BARC-353) Avail: CFSTI

The mercury amalgamation method for the estimation of small quantities of oxygen in sodium is described. Sodium was sampled in an inert atmosphere and sodium samples in vacuum sealed glass ampoules were prepared. These samples were analyzed under vacuum by mercury amalgamation method. Standard addition of oxygen and its recovery was tested. Sodium samples containing as low as 7 ppm of oxygen were analyzed and applicability and accuracy of this method was examined. Author

N69-23844# Bhabha Atomic Research Centre, Bomba (India). Chemistry Div.

DIFFUSION OF RARE EARTH ELEMENTS IN ALUMINUM

S. P. Murarka and R. P. Agarwala 1968 31 p refs

(BARC-368) Avail: CFSTI

Tracer diffusion of lanthanum, cerium, praseodymium, neodymium, and samarium in aluminum was studied using residual activity technique. Experimental results were discussed on the basis of low solid solubility of the tracers. The data on impurity diffusion in aluminum were also examined on the theories of charge and size difference between the impurity and aluminum atoms. Theories based on the vacancy impurity interaction and the size effect were found applicable to almost all the solutes in trivalent aluminum within the limits of accuracy of the experiment. Author

N69-23847# Dow Chemical Co., Golden, Colo. Rocky Flats Div.

RADIOLYSIS OF GASEOUS AMMONIA

Armen R. Kazanjian and Alan K. Brown 22 Nov. 1968 7 p refs

(Contract AT(29-1)-1106)

(RFP-1089) Avail: CFSTI

Ammonia was irradiated by α particles and γ rays, and G values for ammonia decomposition were 3.5 ± 0.2 for α radiolysis and 4.0 ± 0.2 for γ radiolysis. The difference in yields can be attributed either to the difference in linear energy transfer (LET) or the difference in radiation intensity, both of which are unusual effects in gas phase radiolysis. Author (NSA)

N69-23849# Bhabha Atomic Research Centre, Bombay (India). Spectroscopy Div.

ANALYSIS OF GASES IN METALS. THE dc ARC GAS CHROMATOGRAPHIC TECHNIQUE. PART 2: THE DETERMINATION OF HYDROGEN IN METALS

A. P. D'Silva, P. K. Wahi, and S. S. Biswas 1968 14 p refs

(BARC-337) Avail: CFSTI

The dc arc, gas chromatographic technique which was developed for the determination of oxygen and nitrogen in metals has been extended to include the determination of hydrogen. Here argon is used as the inert gas medium, together with a thermal conductivity detector. It is shown that hydrogen from refractory metals like titanium and zirconium is quantitatively evolved, only when a platinum bath is used. Hydrogen in the range, 10-1000 ppm can be determined on a 0.2 gm sample with an average precision of 4%, the detection limit being 1 ppm. Author

N69-23851# Bhabha Atomic Research Centre, Bombay (India). Spectroscopy Div.

FLAME SPECTROPHOTOMETRIC DETERMINATION OF EUROPIUM AND YTTRIUM IN RARE EARTH CONCENTRATES

A. P. D'Silva, T. V. Venkitachalam, and U. R. Narayanaswamy 1968 13 p refs

(BARC-356) Avail: CFSTI

The method was developed after suitably converting a Hilger Uvispek spectrophotometer to obtain recordings of flame spectra. Rare earth concentrates containing europium oxide in the range 0.1 to 2.0%, and yttrium oxide in the range 10 to 100% were analyzed with a reproducibility of ± 2%. The technique has the advantage that with relatively simple spectrometric equipment, reproducible results can be obtained which are not influenced by widely varying matrix composition. Author

N69-23861# Bhabha Atomic Research Centre, Bombay (India). Chemistry Div.

STUDIES IN THE CATALYTIC EFFECTS OF FLUORIDE AND CHLORIDE ON THE OXIDATION OF METAL

T. R. Bhat and I. A. Khan 1968 17 p refs

(BARC-365) Avail: CFSTI

The influence of fluoride and chloride catalysts on the oxidation of Al, Ti, Zr, Mo, Fe, Co, Cu, Zn, W, Ni, Cr, Nb, Ta and Mg metal powders was studied thermogravimetrically. The oxidation rate is considerably increased by both fluoride and chloride catalysts for Al, Ti, Zr, Mo, Fe, Co, Cu, Zn and Cr whereas the rate is reduced for Mg, Nb and Ta. In general, the catalytic effect was greater with fluoride than with chloride except with chromium where chloride has greater influence. In case of tungsten, chloride acts as a positive and fluoride as a negative catalyst and the reverse is the case with nickel. Some possible mechanisms of catalytic action are discussed. Author

N69-23863# Junta de Energia Nuclear, Madrid (Spain).

IRRADIATION OF TERPHENYLS BY FAST ELECTRONS: KINETICS OF DECOMPOSITION OF OM-2 MIXTURES AND EFFECT OF ADDITION OF HB-40

R. Barrera Pinero and Manero Rodriguez 1966 31 p in SPANISH Presented at the Panel on Use of Org. Liquids as Reactor Coolants and Moderators, Vienna, 9–13 May 1966

(Conf-660553-7) Avail: CFSTI

The radiolytic stability of the commercial mixture of terphenyls Frogil-OM2 at temperatures between 150 and 350°C and of various mixtures of OM2 with HB-40 (Monsanto) at 200°C was studied with static methods under electron irradiation at 1 MeV. The radiolytic effect as a function of the dose controls the disappearance

of the initial material, the evolution of gases, and the formation of polymers. The results with respect to OM2 indicate that the decomposition/dose curves are adapted preferentially to a fractional kinetic order, about 1.5. The kinetics of the process are discussed, and a quasi-chain reaction mechanism is followed in which the length of the chain begins to be probably appreciable at temperatures above 400°C. With respect to the effects of the addition of partially hydrogenated terphenyls (HB-40) on the stability of OM2, it was observed that if the values of G(gas) increase always with the total percentage of hydrogenation, the values of G(→ polym) decrease for hydrogenations below 15%, with a minimum at about 10%. Author (NSA)

N69-23868# Los Alamos Scientific Lab., N. Mex.
CADMIUM ACTIVITY IN ITS ALLOYS WITH A SMALL AMOUNT OF GOLD FROM THE EMF OF STIRRED H CELLS
Barton L. Houseman and Guy R. B. Elliott Apr. 1967 12 p refs
(Contract W-7405-eng-36)
(LA-4031) Avail: CFSTI

Stirred H-cell electromotive force measurements on solvent concentration cells of the type, W–Cd, $Au_{(liq\ soln)}/CdI_{2(l)}/Cd_{(l)}$–W, were made with high precision using compositions from 0.001 to 0.021 mole fraction of gold at 673, 742, and 773°K. The results at each temperature, except for narrow transition regions, may be described by two linear equations. All equations are of the form $a_{Cd} = c_1 - k_1 N_{Au}$, which was previously shown to hold for other systems. Solubility and anodic current efficiency measurements are reported. Author (NSA)

N69-23939# United Kingdom Atomic Energy Authority, Harwell (England).
DETERMINATION OF OXYGEN IN SILICON NITRIDE BY INERT GAS FUSION
I. M. Griffin and A. P. Mead Aug. 1968 9 p refs
(AERE-R-5878) Avail: CFSTI; HMSO 25s6d

In the method described the sample, encapsulated in a platinum tube, is reacted with carbon first at 1500°C and then at 2100°C, the carbon monoxide formed at each temperature being removed in a stream of high purity helium. After oxidation of the carbon monoxide with copper oxide the carbon dioxide is frozen out in a multiloop trap and finally measured in an open-well capillary manometer. The two heating temperatures distinguish between "free" or adsorbed oxygen, and combined oxygen. Author (NSA)

N69-23940# Oak Ridge National Lab., Tenn.
DISSOLUTION AND HYDROLYSIS OF METHYL IODIDE IN MISTING SPRAY SOLUTIONS
G. W. Parker, G. E. Creek, and N. R. Horton Jan. 1968 20 p ref
(Contract W-7405-eng-26)
(ORNL-TM-2053) Avail: CFSTI

Experiments indicated that the efficiency of 1.0M $Na_2S_2O_3$ and water sprays for removing CH_3I from the atmosphere are practically identical at room temperature. At approximately 48°C, the 0.1M $Na_2S_2O_3$ efficiency was about the same as that for room temperature, while the water spray efficiency was reduced. Henry's law constants and deposition velocities were calculated. Author (NSA)

N69-23941# United Kingdom Atomic Energy Authority, Harwell (England).
A RADIOMETRIC METHOD OF CONTINUOUSLY MEASURING THE C 14 CONCENTRATION IN CO/CO_2 MIXTURES
W. C. T. Munnoch and D. Williams Jul. 1968 28 p refs
(AERE-R-5324) Avail: CFSTI; HMSO 6s

A ^{14}C tracer was used as an aid in studying the combined effects of irradiation and high temperature on graphite in a CO–CO_2 atmosphere. A method was required for continuously measuring this nuclide in the presence of other beta emitters. The problem is discussed and a successful technique is described. Details are given of energy discriminating and total-counting gas flowcell scintillators and the associated electronic assemblies developed in the course of the work. Author (NSA)

N69-23942# Instituto de Asuntos Nucleares, Bogota (Columbia). Seccion de Quimica.
SEPARATION OF TELLURIUM NUCLEAR ISOMERS IN TELLURIUM DIIODODIMETHYL AND TELLURIUM DIMETHYL PICRATE [SEPARACION DE ISOMEROS NUCLEARES DE TELUROEN DIYODODIMETIL TELURO Y PICRATO DE DIMETIL TELURO]
L. Carrillo and S. J. Nassiff 1967 22 p refs In SPANISH
(IAN-Q-7) Avail: AEC Depository Libraries

The isomers Te 127 and Te 129, previously present in the tetravalent state in molecules of diiododimethyltellurium and dimethyltellurium picrate, were separated. In diiododimethyltellurium the yield for the separation was 94.5 ± 3.5% for Te 127 and 61.4 ± 1.1% for Te 129. In dimethyltellurium picrate the separation was 93.4 ± 3.4% for Te 127 and 64.5 ± 4.0% for Te 129. The isomers of tellurium in the ground state were separated carrier-free. Author (NSA)

N69-23943# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PLUTONIUM RELEASE STUDIES. 3: RELEASE FROM HEATED PLUTONIUM BEARING POWDERS
J. Mishima, L. C. Schwendiman, and C. A. Radasch Jul. 1968 44 p refs
(Contract AT(45-1)-1830)
(BNWL-786) Avail: CFSTI

Four plutonium compounds in powder form, the oxide, partially oxidized oxalate, and fluoride, were subjected to high temperature in air drawn up and around the material at various velocities. Under the conditions of these experiments, the greatest amount, at a rate of 0.90 wt %/hr, was released by plutonium oxalate at 700°C in an upsweep of air at 100 cm/sec. The partially oxidized oxalate, the most readily entrained, showed significant release rates at all air velocities at 1000°C, and at all temperatures in air moving at 100 cm/sec. Release rates ranged from 0.25 to 0.82 wt%/hr at 1000°C and 0.057 to 0.82 wt%/hr in air with a velocity of 100 cm/sec. The smallest fraction was released by the fluoride during the runs, 0.05 wt%/hr at 1000°C in an air velocity of 100 cm/sec. The residue remaining from the overheating of the fluoride appeared susceptible to further entrainment. Author (NSA)

N69-23949# Atlantic Richfield Hanford Co., Richland, Wash.
SAFE U 235 ENRICHMENTS FOR THE PUREX FACILITY
G. R. Kiel and K. R. Ridgway 1 Mar. 1968 9 p refs
(Contract AT(45-1)-2130)
(ARH-407) Avail: CFSTI

The safe processing of uranium enrichments greater than 1.0 wt % ^{235}U required a study to determine what enrichments could safely be processed. The control of criticality safety outside of geometrically favorable equipment is considered. Where precipitation is not probable (requiring three or more independent operational errors), concentration control is used and advantage is

taken of the nitrogen poisoning in uranyl nitrate solutions with or without plutonium. Where precipitation of uranium solutions is possible (requiring less than three independent operational errors), the maximum uranium density of the given precipitate is used to determine the enrichment limitation. For precipitated uranium-plutonium mixtures the Pu/U ratio of the precipitate is considered to be twice that of the original solution and the limiting equivalent enrichment is based on that ratio. Author (NSA)

N69-23951# Princeton Univ., N. J. Frick Chemical Lab.
THE LIQUID CRYSTAL PHASE OF POLY-GAMMA-BENZYL-L-GLUTAMATE IN SOLUTION AND IN THE SOLID STATE
E. T. Samulski and A. V. Tobolsky Nov. 1968 33 p refs
(Contract N00014-67-A-0151)
(AD-680461; TR-110) Avail: CFSTI CSCL 7/4

Concentrated solutions and solid films of Poly-gamma-benzyl-L-glutamate were examined using proton magnetic resonance, X-ray diffraction and optical microscopy. The unusual findings can be correlated with the cholesteric-like liquid crystal phase known to exist in concentrated solutions of this polypeptide. The continuity in these observations on passing from the liquid to the solid state is interpreted in terms of the existence of a helicoidal structure in the solid state of PBLG derived from that found in the liquid crystal phase. Author (TAB)

N69-24048# Atlantic Richfield Hanford Co., Richland, Wash.
CRITICALITY PREVENTION DURING THE STORING AND TRANSPORTING OF FISSILE MATERIALS IN THE CHEMICAL PROCESSING DIVISION
R. P. Corlew 10 Dec. 1968 8 p refs
(Contract AT(45-1)2130)
(ARH-952) Avail: CFSTI

Criticality prevention procedures necessary for the safe shipment or receipt of fissile materials in solid or solution form are presented. Responsibilities, posting and labeling requirements, and quantities and forms of fissile materials constituting 20% of a minimum critical mass are included. NSA

N69-24063# Israel Program for Scientific Translations, Ltd., Jerusalem.
ELECTROCHEMISTRY. ELECTRODEPOSITION OF METALS AND ALLOYS
N. E. Khomutov ed. 1969 191 p refs Transl. into ENGLISH of the Book "Elektrokhimiya. Elektrosazhdenie Metallov i Splavov" Moscow, 1966 Submitted for publication Published for Dept. of Com. and NSF Achievements of Sci.: Chem. Ser., Issue 1
(TT-68-50452) Copyright. Avail: CFSTI

CONTENTS:

1. TABLE OF MOLAL STANDARD ELECTRODE POTENTIALS AND THEIR TEMPERATURE COEFFICIENTS IN AQUEOUS SOLUTIONS AT 25°C N. E. Khomutov p 2–27 refs (See N69-24060 12-06)

2. ELECTRODEPOSITION OF ALLOYS K. M. Gorbunova et al p 28–70 refs (See N69-24065 12-06)

3. ELECTRODEPOSITION OF MAGNETIC ALLOYS V. V. Bondar' et al p 71–110 refs (See N69-24066 12-06)

4. PRESENT STATE OF THE THEORY OF CHROMIUM ELECTRODEPOSITION FROM CHROMIC ACID BATHS A. T. Vagramyan et al p 111–145 refs (See N69-24067 12-06)

5. ELECTRODEPOSITION OF CHROMIUM AND ITS ALLOYS N. I. Potapov et al p 146–181 refs (See N69-24068 12-06)

6. ELECTRODEPOSITION OF RARE METALS AND ALLOYS N. I. Mikhailov et al p 182–185 refs (See N69-24069 12-06)

N69-24064# Israel Program for Scientific Translations, Ltd., Jerusalem.
TABLE OF MOLAL STANDARD ELECTRODE POTENTIALS AND THEIR TEMPERATURE COEFFICIENTS IN AQUEOUS SOLUTIONS AT 25°C
N. E. Khomutov *In its* Electrochem. Electrodeposition of Metals and Alloys 1969 p 2–27 refs (See N69-24063 12-06)
Copyright. Avail: CFSTI

The table of standard potentials gives detailed information on the sources, the methods of measurement, and the accuracy of E°. The table contains values (T) calculated by thermodynamic methods, and experimental values of E°. The introduction to the table includes a report on the convention of the signs of E° and their temperature coefficients, the forms of writing electrode systems and electrode potentials, a discussion on sources of error in the experimental and calculated values of E°, and other data on the problem of standard electrode potentials. The data are based on surveys and articles. Author

N69-24065# Israel Program for Scientific Translations, Ltd., Jerusalem.
ELECTRODEPOSITION OF ALLOYS
K. M. Gorbunova et al *In its* Electrochem. Electrodeposition of Metals and Alloys 1969 p 28–70 refs (See N69-24063 12-06)
Copyright. Avail: CFSTI

The problem of the relationship between the thermodynamic and kinetic conditions for the reduction of metals, alloy components on the one hand and the phase structure of the alloy on the other is reviewed. The main factors are examined leading to changes in the thermodynamic and kinetic parameters of the ion discharge process in the codeposition of metals (influence of the activity of ions in the solution and changes in the energy state of metal atoms in alloy formation). An analysis of the different aspects of the simultaneous cathodic reduction of several metals showed some factors that are related to the kinetics of the process in the same way as in the electrodeposition of pure metals. Summary data are also presented on the phase structure of alloys as a function of the cathodic overpotential during deposition and of the process rate; the role of surface active components of the solutions in the determination of the phase structure of alloys; the phase structure of alloys deposited from coupled electrolytes; and the dependence of the kinetics of the reduction of metal ions on the phase structure of the electrodeposited alloys. B.P.

N69-24066# Israel Program for Scientific Translations, Ltd., Jerusalem.
ELECTRODEPOSITION OF MAGNETIC ALLOYS
V. V. Bondar' et al *In its* Electrochem. Electrodeposition of Metals and Alloys 1969 p 71–110 refs (See N69-24063 12-06)
Copyright. Avail: CFSTI

Specifications are given for coatings for magnetic storage of data, for computer memories, for shielding against external magnetic fields, and for production of magnetic circuits. The relationship is examined between magnetic properties and the internal structure of ferromagnetic materials. A survey is made of the magnetic properties of thin electrodeposited films of cobalt, nickel, and iron and chemically deposited films of metals combined with phosphorus. Hard magnetic coatings of cobalt type alloys are reviewed. The mechanism of depositon of phosphorus with iron group metals is examined. The production of soft magnetic alloy coatings and the magnetic anisotropy of thin films of these alloys are also reviewed. The data showed that the magnetic properties of coatings (e.g., coercive force, remanent and maximum magnetic induction, rectangularity of hysteresis loops) are chiefly affected by the following factors: the chemical and phase constitution of the coatings (for a given alloy), the phase structure, the internal stresses, and the size and preferential orientation of the crystals. B.P.

N69-24067# Israel Program for Scientific Translations, Ltd., Jerusalem.
PRESENT STATE OF THE THEORY OF CHROMIUM ELECTRODEPOSITION FROM CHROMIC ACID BATHS
A. T. Vagramyan et al *In its* Electrochem. Electrodeposition of Metals and Alloys 1969 p 111–145 refs (See N69-24063 12-06)
Copyright. Avail: CFSTI

The results show that the electrodeposition of chromium differs appreciably from that of other metals, and is a very complicated process involving a number of correlated reactions. The ratio of the rates of these reactions is determined mainly by the surface state of the electrode, which changes markedly as a function of the bath composition and the electrolysis conditions. The surface state is affected most strongly by the nature and concentration of some foreign anions. The presence of foreign anions causes a marked change in the nature of the relationship between the electrode potential and the current density. From analyses of the composition and studies on the properties of the cathodic film, it was possible to establish the electrochemical conditions for the deposition of new alloys of chromium with other metals, and this was confirmed by experiment. The electrodeposition of chromium can be regarded as an example of the importance of the surface state of the electrode in studies on the kinetics of electrode processes. Author

N69-24068# Israel Program for Scientific Translations, Ltd., Jerusalem.
ELECTRODEPOSITION OF CHROMIUM AND ITS ALLOYS
N. I. Potapov et al *In its* Electrochem. Electrodeposition of Metals and Alloys 1969 p 146–161 refs (See N69-24063 12-06)
Copyright. Avail: CFSTI

From an analysis of the present literature on the problem of chromium plating from solutions containing trivalent and divalent chromium ions it was concluded that although certain advances have been made, none of the reported baths can be used for commercial chromium plating for the following reasons: (1) the electrolytes were not stabilized and the composition of the electrolyte changes during the electrolysis, which interferes with the normal course of the process; (2) no effective buffer additives were found; (3) the mechanism of discharge of trivalent chromium ions, which is of great theoretical and practical interest, has not been adequately studied. Literature data is also summarized on the electrodeposition of chromium alloys from hexavalent chromium baths. The difficulties associated with the deposition of these alloys are assessed. B.P.

N69-24069# Israel Program for Scientific Translations, Ltd., Jerusalem.
ELECTRODEPOSITION OF RARE METALS AND ALLOYS
N. I. Mikhailov et al *In its* Electrochem. Electrodeposition of Metals and Alloys 1969 p 162–185 refs (See N69-24063 12-06)
Copyright. Avail: CFSTI

The literature is reviewed and summarized on data concerning the electrodeposition of beryllium, gallium, indium, thallium, germanium, titanium, zirconium, vanadium, molybdenum, tungsten, and rhenium metals and alloys. The properties of coatings of these materials are evaluated. B.P.

N69-24077# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
WASHOUT OF METHYL IODIDE BY HYDRAZINE SPRAYS
Final Report
L. C. Schwendiman, R. A. Hasty, and A. K. Postma Nov. 1968 69 p refs
(Contract AT(45-1)-1830)
(BNWL-935) Avail: CFSTI

Analysis of the effectiveness and merit of hydrazine for use as a spray additive for washing methyl iodide from containment atmospheres following a reactor accident is determined. Two principal areas were studied: the physiochemical aspects of the hydrazine-water-methyl iodide system, and the washout of methyl iodide with hydrazine solution sprays. Methods and apparatus were developed for measuring the reaction rate of methyl iodide and aqueous solutions of hydrazine. Rate constants were measured for temperatures from 24.6 to 64.7°C and for various hydrazine concentrations. The reaction rate was determined to be second order. The activation energy was calculated to be 20.2 Kcal/mol. Reaction rates with 1,1-dimethylhydrazine monomethyl hydrazine, and some sulfur based compounds were determined for comparative purposes. The reaction rate with hydrazine was found to be essentially independent of OH^- concentration. Author (NSA)

N69-24081# Toledo Univ., Ohio. Dept. of Chemistry.
CHEMICAL EFFECTS OF NUCLEAR TRANSFORMATIONS. FLASH HEATING OR FLASH PHOTOLYSIS Technical Progress Report, 1 Feb.–31 Dec. 1968
Jack G. Kay Dec. 1968 6 p refs
(Contract AT(11-1)-1684)
(COO-1684-6) Avail: CFSTI

It was found that the flash heating pretreatment of γ-alumina has no significant effect on its catalytic activity. Photoluminescence experiments were carried out on $KMnO_4$ crystals at liquid nitrogen temperatures. Vibrational analysis for the electronic absorption spectrum of TiF was completed. A high-resolution spectrum of vaporized MnO was obtained using ^{18}O labeling. NSA

N69-24097# Pittsburgh Univ., Pa. Dept. of Chemistry.
BIOLOGICAL APPLICATIONS OF MOSSBAUER SPECTROSCOPY Progress Report, May 1967–Feb. 1968
L. M. Epstein and Darel K. Straub Feb. 1968 72 p refs
(Contract AT(30-1)-3859)
(NYO-3859-1) Avail: CFSTI

Data from Moessbauer spectroscopy, nuclear magnetic resonance spectroscopy, and low-temperature magnetic susceptibility measurements were collected for a number of five-coordinated ferric porphyrins, including halo, thiocyano and hydroxo derivatives. Some known dimeric ferric complexes containing bridging or hydroxide were also investigated. An extensive series of tris (N,N-disubstituted dithiocarbamato)iron(III) compounds and halo (and thiocayne) bis(N,N-di-substituted dithiocarbamato)iron(III) compounds were prepared and their Moessbauer spectra obtained. Several thiocyanobis(N,N-disubstituted dithiocarbamato)iron(III) complexes were prepared for the first time. Author (NSA)

N69-24121# United Kingdom Atomic Energy Authority, Harwell (England).
ANODIC OXIDATION OF SILICON
M. A. Wilkins Aug. 1968 15 p refs
(AERE-R-5875) Avail: CFSTI; UK 3s

In order to measure concentration profiles of ions implanted into thin silicon wafers it was necessary to remove thin and even layers from the irradiated surface. The method adopted was to oxidize the silicon surface anodically and then remove the oxide with dilute HF. The effects of current density and temperature on the oxidation were investigated, and the rate of formation of the oxide was determined. It was concluded that the method is very satisfactory. The possibility of obtaining information on the mode of electrical conduction through the oxide was also investigated. The efficiency of anodic oxidation for Si is very low, and most of the conduction must be electronic. It has been suggested that the current is due to injection of electrons by tunneling from the electrolyte into the oxide conduction band. By contrast, thermally

grown SiO_2 shows very little conduction, and there are also physical differences between the anodic and thermally grown oxides. NSA

N69-24149# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
DETERMINATION OF TRACE ZINC IN LITHIUM COMPOUNDS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
R. E. Barringer, H. G. King, and A. D. Condrey 3 Feb. 1969 23 p refs
(Contract W-7405-eng-26)
(Y-1661) Avail: CFSTI

Two procedures were developed for determination of zinc in lithium compounds by atomic absorption spectrophotometry: a direct method of aspirating a lithium solution into the burner of an atomic absorption spectrophotometer gave a sensitivity to four micrograms zinc per gram of lithium; and a method in which zinc was extracted into 2-heptanone before aspiration could be extended readily to a sensitivity of 0.1 microgram zinc per gram of lithium. Author (NSA)

N69-24190# Los Alamos Scientific Lab., N. Mex.
THE COMBUSTION MANOMETRIC DETERMINATION OF CARBON IN PLUTONIUM SULFIDE
Carolyn S. Mac Dougall Maynard E. Smith, and Glenn R. Waterbury 9 Jan. 1969 9 p refs
(Contract W-7405-eng-36)
(LA-4047) Avail: CFSTI

A combustion-manometric method was modified for application to determination of carbon in the ppm concentration range in plutonium sulfide. The most important modification was the selective trapping of the sulfur oxides, formed during combustion of the sample, to prevent their collection and subsequent contribution to the pressure measured manometrically. The most effective absorbent was chromium trioxide moistened with 18M sulfuric acid. In lieu of plutonium sulfide standards having known carbon contents, samples of plutonium sulfide, previously determined to be homogeneous, were analyzed repeatedly to estimate the reliability of the method. Carbon, in the form of graphite or as a trace impurity in plutonium metal, was added to the sulfides before analysis. The standard deviation calculated from these analyses was about 5 relative % for determining carbon at the 400-ppm level. Interference from the sulfur oxides was not observed with the modified method. Author (NSA)

N69-24282*# Tyco Labs., Inc., Waltham, Mass.
ALUMINUM CHLORINE BATTERY Quarterly Report
Jose Giner and Brian Burrows Oct. 1968 27 p refs
(Contract NAS12-688)
(NASA-CR-100763; QR-1) Avail: CFSTI CSCL 07D

A molten salt system based on Al and Cl_2 carbon electrodes with an $AlCl_3$–alkali chloride eutectic as electrolyte offers promise as a rechargable, high energy density battery, which can operate at a relatively low temperature and may withstand sterilization. Work was carried out to obtain pure NaCl–KCl–$AlCl_3$ electrolytes and to do preliminary studies of both Al and Cl_2 electrodes. Different commercial aluminum chloride materials were investigated. Using cyclic voltammograms it has been found that the major impurity in all these materials is Fe^{3+}. A treatment with highly dispersed Al powder was partially successful in purifying this electrolyte. Investigation of the Al anode shows the feasibility of steady state current densities up to 50 ma/cm^2. Preliminary experiments on the Cl_2 electrode using porous graphite as substrate show that graphite is severely attacked by the melt. The attack caused considerable swelling, suggestive of interplanar attack. Presumably, $AlCl_3$ is responsible. Author

N69-24286# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Chemistry.
THE STEADY STATE DIFFUSION-CONTROLLED GROWTH OF AN AEROSOL PARTICLE FALLING THROUGH AIR
H. L. Frisch and F. C. Collins 1969 10 p
(Contract AF 19(122)-412)
(AD-680690; SR-3) Avail: CFSTI CSCL 7/4

The effect of the velocity of a freely falling aerosol droplet upon its diffusion-controlled growth rate is evaluated. It is found that the velocity of the droplet in the diffusion field does not significantly accelerate its growth unless the radius of the particle exceeds .010 cm. Thus it appears that the effect of the gravitational fall of aerosol droplets during their growth from the supersaturated vapor may be safely neglected. Author (TAB)

N69-24292# California State Coll., Los Angeles. Dept. of Chemistry.
A CORRELATION OF NUCLEAR MAGNETIC RESONANCE CHEMICAL SHIFTS IN PYRAMIDAL BORONS COMPOUNDS USING A CONICAL RING CURRENT MODEL Interim Report
Dennis Marynick and Thomas Onak Nov. 1968 22 p refs
(Contract Nonr-3364(00))
(AD-680621; TR-20) Avail: CFSTI CSCL 7/2

By adopting a classical free electron model for the pentagonal pyramidal systems $CnB(6-n)H(10-n)$ (n = 0,1,2,3,4) and for the tetragonal pyramidal pentaborane and pentagonal bipyramidal 2,4-$C2B5H7$ it is possible to account for the relative chemical shifts of boron and terminal hydrogen atoms. Also a good correlation is obtained for alkyl protons in those methyl and ethyl derivatives for which spectra are available. In this approach the pyramidal framework is treated as a cone and one or more ring current loops are placed about the conical curved surface parallel to the base. The six delocalized electrons bonding the apex to the base are treated in a manner similar to the ring current approach used for benzene. From the obtained correlations it is clear that this approach has considerable predictive value. Author (TAB)

N69-24300# Catholic Univ. of America, Washington, D. C. Dept. of Chemistry.
RAMAN SPECTRA OF FUSED INDIUM AND BISMUTH CHLORIDES
J. T. Kenney and F. X. Powell [1968] 16 p refs
(Contract N60921-7160(FBM))
(AD-680037) Avail: CFSTI CSCL 7/4

The paper extends the study of Raman spectroscopy of the chlorides of bismuth and indium in the molten state. The object in the case of bismuth was to determine whether any significant structural changes occur as the result of changing chloride concentration. In the case of indium an attempt was made to assign the oxidation state in fused salt media by determining the structures present in the molten state. Author (TAB)

N69-24304# North Carolina Univ., Chapel Hill. Materials Research Center.
[RESEARCH ACTIVITIES IN THE FIELD OF MATERIALS SCIENCE] Annual Technical Progress Report, 1 Jul. 1967-30 Jun. 1968
Jun. 1968 111 p refs
(Contract ARPA SD-100)
(AD-680067) Avail: CFSTI CSCL 11/7

This report comprises brief summaries of materials research projects at the University of North Carolina at Chapel Hill for the year ending 30 June 1968. Brief reports are given of progress in various individual research programs active during the period July

1967 - June 1968. They are arranged by Academic Departments and Schools, and within departments alphabetically by the name of the principal investigator. In many cases where work has reached the publication stage, the abstract is quoted. TAB

N69-24308# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
SOME COMMENTS ON THE METHODOLOGY OF LINE-BROADENING ANALYSES
R. L. Rothman and J. B. Cohen 1 Jan. 1969 11 p refs
(Contract N00014-67-A-0356)
(AD-680465; TR-1) Avail: CFSTI CSCL 7/4

The report concerns two items often associated with Fourier analysis of x-ray line broadening: the Rachinger separation and the Stokes correction. Author (TAB)

N69-24339# Technische Hochschule Munchen (West Germany). Institut fuer Organische Chemie.
ORIENTATION IN DIENE SYNTHESES WITH NITROSO AROMATICS, AND DIELS–ALDER ADDUCTS FROM NITROSO COMPOUNDS AS INTERMEDIATE PRODUCTS IN THE SYNTHESIS OF PYRROLE KETONES [ORIENTIERUNG BEI DIENSYNTHESEN MIT NITROSOAROMATEN, SOWIE DIELS-ALDER-ADDUKTE AUS NITROSOVERBINDUNGEN ALS ZWISCHENPRODUKTE BEI SYNTHESEN VON PYRROLKETONEN]
Heinz Braun (Ph.D. Thesis) 1968 133 p refs in GERMAN
Avail: CFSTI

In the orientation studies, eight different 4-aryl- or 4-heteroaryl-substituted butadiene-1-carbonic acid esters were prepared; their trans-trans structure was spectroscopically verified. The steric influence of the diene substituents on the orientation during the Diels-Alder reaction of 1,4-disubstituted dienes with nitrosobenzene was investigated. The effects of acceptor or donator heterocyclics on orientation were examined in reactions of 4-heteroaryl-substituted butadiene-1-carbonic acid esters with nitrosobenzene. A new preparative application of the ketodiene synthesis with nitroso aromatics which yields derivatives of the pyrrole ketone series is described. The yield of raw pyrrole ketones is approximately 60%. Transl. by K.W.

N69-24340# Technische Hochschule Munchen (West Germany). Institut fuer Organische Chemie.
STUDIES OF ANTHRAQUINONE PIGMENTS OF DERMOCYBE SANGUINEA (WULF. EX FR.) WUENSCHE AND RELATED CLASSES [UNTERSUCHUNGEN UEBER DIE ANTHRACHINONPIGMENTE VON DERMOCYBE SANGUINEA (WULF. EX FR.) WUENSCHE UND VERWANDTER ARTEN]
Walter Loesel (Ph.D. Thesis) 1968 78 p refs in GERMAN
Avail: CFSTI

Isolation, separation, structure, and biogenesis of pigments of the mushrooms *Dermocybe sanguinea, D. semisanguinea, D. miliceria*, and *D. cinnamomeoluteus* were studied. In addition to the known neutral anthraquinone pigments, a number of anthraquinone carbonic acids were separated by chromatographic methods and isolated in pure forms. One of these acids was found to be identical with endocrocin, which thus for the first time was isolated in higher mushrooms. The structures of four other acids were spectrographically determined. The presence of emodin and dermocybin in *D. sanguinea* in the form of glycosides was clearly proven for the first time. The structure of dermocybin and its change into a mono-amino-desoxy derivative in the presence of aqueous ammonia at room temperature was established. Transl. by K.W.

N69-24383# American Meteorological Society, Boston, Mass.
IMPROVEMENT IN THE THEORETICAL DETERMINATION OF THE FINE STRUCTURE OF TERMS OF ATOMIC SPECIES OF BORON, CARBON, AND NITROGEN TYPE
A. P. Iutsis and R. S. Dagis Bedford, Mass. AFCRL Oct. 1968 19 p refs Transl. into ENGLISH from Tr. Akad. Nauk Lit. SSR (Vilna), ser. B, v. 1, no. 21, 1960 p 59–70
(AD-680366; AFCRL-68-0567; AFCRL-Trans-27) Avail: CFSTI CSCL 7/4

The state of theoretical determination of the fine structure of light atoms is described. It is shown that the approximation of the two-electron states model must be used when the calculation of the fine structure is refined on the basis of a multiconfiguration approximation. The expression for the matrix elements of spin-dependent interactions is derived for the case of two unfilled shells and specialized for the case where one of the shells is filled. Expressions are found for the interaction matrix elements between two equivalent p, d and f electrons and a filled s shell. The results of determining the fine structure of boron, carbon, and nitrogen are given. Results have been improved by using the multiconfiguration approximation on the basis of the two-electron states model. TAB

N69-24387# Mound Lab., Miamisburg, Ohio.
DETERMINATION OF FREE ACIDITY IN CONCENTRATED AQUEOUS SOLUTIONS OF PLUTONIUM (4)
Nicole Damien et al 11 Nov. 1968 26 p refs Transl. into ENGLISH from Anal. Chim. ACTA (Amsterdam), no. 41, 1968 p 483–495
(Contract AT(33-1)-GEN-53)
(MLM-1575(TR)) Avail: CFSTI

A method for the determination of free acidity in concentrated aqueous solutions of plutonium (4) is described. The plutonium–EDTA complex is formed by addition of the calcium–EDTA complex, and the neutralization titration with sodium hydroxide is followed potentiometrically, the equivalence point being determined by a graphical method. The relative standard deviation is 1%. Uranium and iron in small amounts do not interfere. The method is applicable to solutions which are ca 1 N in acid and which contain up to 200 g Pu/l. Author (NSA)

N69-24448# Army Biological Labs., Fort Detrick, Md.
ON THE STRUCTURE OF WATER
O. Ya. Samoilov and N. S. Kurnakova Nov. 1968 10 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Ukraine), v. 9, no. 4, 1964 p 387–393
(AD-680492; Trans-2358) Avail: CFSTI CSCL 7/4

A review is given of the contemporary state of the problem concerning the structure of water. TAB

N69-24458# California Univ., Berkeley. Thermal Systems Div.
GENERAL FORMULATION AND NUMERICAL SOLUTION OF REACTION RATE PROBLEMS
Peteris Purgalis and Robert F. Sawyer Jun. 1968 93 p refs
(Grant AF-AFOSR-1256-67)
(AD-680043; TS-68-4; AFOSR-68-1624) Avail: CFSTI CSCL 7/4

A scheme for constructing the rate equations for a general chemical reaction mechanism consisting of any number of elementary equations and chemical species was devised. The elementary reaction equations do not require special coding and can be written in terms of their chemical symbols. The construction of the rate equations and their solution using the fourth order Runge-Kutta method were programmed for the CDC-6400 computer. The equations can be solved for the following conditions: isothermal constant volume; isothermal constant pressure; specified

temperature and pressure variaton; adiabatic constant volume; adiabatic constant pressure; adiabatic with specified pressure variation. The adiabatic cases can be modified by allowing heat transfer. A description of the computer program and sample calculations are presented. Author (TAB)

N69-24467# Army Biological Labs., Fort Detrick, Md.
THE NONSTATIONARY EVAPORATION AND GROWTH OF DROPLETS, CHAPTER 3
Jul. 1968 9 p Transl. into ENGLISH from Itogi Nauki: Fiz. Mat. Nauki, Akad. Nauk SSSR (Moscow), no. 1, 1958 p 79–87
(Trans-301) Avail: CFSTI CSCL 7/4

The nonstationary evaporation and growth of droplets, Chapter III—Translation. TAB

N69-24474# Technische Hochschule Munchen (West Germany).
RHENIUM CARBONYL COMPLEXES WITH CHALCOGEN CONTAINING LIGANDS [UEBER RHENIUMCARBONYLKOMPLEXE MIT CHALKOGENHALTIGEN LIGANDEN]
Wolfgang Rohm (Ph.D. Thesis) 1968 71 p refs In GERMAN
Avail: CFSTI

Reactions of rhenium carbonylchlorides with organic sulful ligands of thioamides, thiocarbonyl acids, amino- and dimercaptanes, and mercatocarbonic acids resulted in halogen free compounds of chelate structure. Rhenium carbonylhalogenides formed disubstituted diorganylchalcogenides or halogen bounded monosubstituted tricarbonyl compounds. Ligand exchange depended on the type of halogen or chalcogen used and the chain break location depended on the basicity and halogen of the ring structure. Transl. by G.G.

N69-24479# Technische Hochschule Munchen (West Germany).
STUDY OF THE EFFECT OF ELECTRIC FIELDS ON CHEMICAL BONDS BY QUANTUM-CHEMICAL ABSOLUTE CALCULATIONS ACCORDING TO THE SCF-MO-LO(LCGO) METHOD [UNTERSUCHUNGEN UEBER DEN EINFLUSS ELEKTRISCHER FELDER AUF DIE CHEMISCHE BINDUNG MIT HILFE QUANTENCHEMISCHER ABSOLUTRECHNUNGEN NACH DEM SCF-MO-LC(LCGO)-VERFAHREN]
Peter Schmittinger (Ph.D. Thesis) 18 Nov. 1968 107 p refs In GERMAN
Avail: CFSTI

Quantum chemical calculation methods were used to determine the effects of strong electrical fields on chemisorption of halogen ions in watery solutions onto electrodes. Optimal wave functions and zero coordination points in the fields were used in example calculations on bonding energies of halogen ions in hydrogen fluoride, methyl chloride, sodium chloride, lithium chloride, hydrochloric acid, sodium fluoride, and lithium fluoride. It was found that strong positive fields decreased the equilibrium distance and weakened bonding energies whereas negative electric fields strengthened molecular bonding energies. Molecular disintegration of hydrogen fluoride molecule took place at a field strength of $> + 1.3 \times 10^7$ V/cm. Calculations for the Cl^- ion using 6 s-functions and 3 p-groups in each coordinate established an overall energy of −452.40147 at. Evalustion of the methyl chloride molecule at various field strengths and with different C-Cl lengths found a strong reciprocal polarization between the orbitals. Dipole moment changes of the H_2O molecule at fields of more than 10^8 V/cm were attributed to the polarization of the fourth orbital. Transl. by G.G.

N69-24481# Technische Hochschule Munchen (West Germany). Anorganisch-chemischen Lab.
NEW AROMATIC METAL-CARBONYL COMPOUNDS OF VANADIUM, CHROMIUM AND MANGANESE [UEBER NEUE AROMATEN-METALL-CARBONYL-VERBINDUNGEN DES VANADINS, CHROMS UND MANGANS]
Robert Schneider (Ph.D. Thesis) 1968 64 p refs In GERMAN
Avail: CFSTI

Reported is the synthesis of a dicyclopentadienyl-divanadine-pentacarbonyl compound with metal-metal bonds. Its pronounced reactivity is used to form numerous dimeric and monomeric complexes. Also described is the photochemical analyses of new carbonyl-metallates and their protonization reactions with various acids. Transl. by G.G.

N69-24482# Technische Hochschule Munchen (West Germany). Fakultaet Fuer Allgemeine Wissenschaften.
AN ELECTROCHEMICAL METHOD FOR THE STUDY OF THE SPECTRAL SENSITIZATION AND HETEROGENIC PHOTOCHEMICAL REACTIONS OF ZnO ELECTRODES [EINE ELEKTROCHEMISCHE METHODE ZUM STUDIUM DER SPEKTRALEN SENSIBILISIERUNG UND HETEROGENER PHOTOCHEMISCHER REAKTIONEN AN ZNO-ELEKTRODEN]
Helmut Tributsch (Ph.D. Thesis) Oct. 1968 124 p refs In GERMAN
Avail: CFSTI

The spectral sensitivation mechanism on semiconducting zinc oxide electrodes was studied by the electrochemical kinetics of surface adsorbed electrolytic dies. Light activated photochemical sensitivation processes changed the electrolyte composition and decayed the adsorbed layer by direct electron transfer from the excited dye molecule to the conduction band of the semiconductor. Transl. by G.G.

N69-24503# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
RADIATIVE LIFETIMES IN THE RESONANCE SERIES OF ArI
George M. Lawrence Aug. 1968 25 p refs *Its* Res. Commun. No. 70
(AD-680671; Douglas-Paper-5213) Avail: Issuing Activity CSCL 7/4

Radiative lifetimes of the six lowest-energy J = 1 levels of Ar I were measured with a pulsed electron technique. The wavelengths and measured lifetimes in nanoseconds are given. Estimates of branching ratios were made where necessary, and f-values for the above transitions are given. Lifetimes of cascading levels estimated with a two-exponential fit are consistent with known lifetimes of Ar I visible lines. Extrapolation to zero pressure to account for photon entrapment was made for lifetimes enlarged less than 30 percent. Author (TAB)

N69-24523# Catholic Univ. of America, Washington, D. C. Dept. of Chemistry.
RAMAN SPECTRA OF MOLTEN MANGANESE DICHLORIDE, THALLIUM TRICHLORIDE, AND TIN DIBROMIDE
J. T. Kenney and F. Powell 1968 9 p
(Contract N60921-7160)
(AD-680039) Avail: CFSTI•CSCL 7/4

This paper presents Raman spectra that have been obtained from three ionic melts. The extent of coordination of Mn(+2) in the MnCl2.KCl eutectic and Tl(+3) in chloride melts is examined by means of their Raman spectra. In addition, the species present in fused SnBr2 was also studied. Author (TAB)

N69-24527# American Meteorological Society, Boston, Mass.
CALCULATION OF THE MAGNETIC HYPERFINE STRUCTURE OF SPECTRAL LINES WITH ALLOWANCE FOR THE FINITE SIZE OF THE ATOMIC NUCLEUS AND A STUDY OF THE DENSITY OF NUCLEAR MAGNETISM
V. V. Klingo Bedford, Mass. AFCRL Oct. 1968 20 p refs Transl. into ENGLISH from Vilniaus, Mokslo Darbai (Lithuania), no. 25, ser. B, 1958 p 89–99
(AD-680365; AFCRL-68-0566; AFCRL-Trans-26) Avail: CFSTI CSCL 7/4

A formula is derived for the correction of the hyperfine structure constant owing to the fact that nuclear magnetism differs in nature from a point magnetic dipole. A possible form of the angular part of the magnetic density is examined for a specified radial part of the density of nuclear magnetism. These angular parts are phenomenologically defined and are able to make a contribution to the magnetic hyperfine structure constant. This contribution is required to close the gap between theory and experiment for the atoms: He3, Li6, Na22, and Na23. TAB

N69-24538# Stanford Research Inst., Menlo Park, Calif.
CATALYTIC REACTIONS OF DISSOCIATION PRODUCTS OF AMMONIUM PERCHLORATE
Henry S. Inami and Henry Wise Jan. 1969 8 p refs
(Contract Nonr-3415(00))
(AD-680654) Avail: CFSTI CSCL 7/4

The report discusses an experimental study of the decomposition kinetics of ammonium perchlorate demonstrated that the action of the catalyst copper chromite in contact with solid AP differs markedly from that of the catalyst in contact with the gaseous dissociation products of ammonium perchlorate. On exposure to ammonia and perchloric acid at 675K the catalyst looses rapidly its activity. A process which appears to be due to the oxidation of chromium cation from the plus 3 to a higher oxidation state. Author (TAB)

N69-24547# Minnesota Univ., Minneapolis. Dept. of Chemistry.
POLYNUCLEAR HYDROXO COMPLEXES Final Scientific Report, 1 Oct. 1964– 30 Sep. 1968
R. Stuart Tobias Sep. 1968 13 p refs
(Grants AF-AFOSR-691-65; AF-AFOSR-691-67)
(AD-680027; AFOSR-68-2881) Avail: CFSTI CSCL 7/2

The hydrolytic condensation reactions of several organometallic compounds were studied in detail. Among the systems examined were (CH3)2Sn(IV), (CH3)2Ga(III), (CH3)2Au(III) and (CH3)3Pt(IV). It was found that the presence of alkyl groups in the first coordination sphere of metal ions labilizes the remaining ligands to a very great degree. This is especially apparent with the classically inert Pt(IV) species where the average lifetime of a bound water molecule of (CH3)3Pt(OH2)3(+) was found. Both the exchange rate and the hydration number of this cation were determined with Oxygen-17 n.m.r. The ion (CH3)2Au(+) was shown with Raman spectroscopy to have the cis structure in aqueous solutions. The thermodynamics of the condensation reaction were examined in solution at 25C, and the end product was found to be [(CH3)2AuOH]4. A complete crystal structure determination was made for this compound. Because the lability of these complexes leads to very fast reactions, the rates were too high to be determined using flow systems. The hydrogen isotope effect on the acid dissociation of (Co(NH3)5OH2)(+3) was examined and found to be normal, and the acid dissociation of coordinated water molecules does not seem to give rise to anomalous isotope effects. Author (TAB)

N69-24584# Harry Diamond Labs., Washington, D. C.
SPECTRUM TRANSITIONS AND THEIR WAVELENGTHS FROM 2000 TO 10,000 A FOR RARE GAS ATOMS
Robert T. Young Oct. 1968 134 p refs
(AD-680198; HDL-TM-68-27) Avail: CFSTI CSCL 7/4

The air wavelengths between 2000 and 10,000 A for all possible transitions of neutral rare gas atoms have been computed. The wavelengths are listed in two sets of tables: arranged by multiplets and arranged in order of decreasing wavelengths. Author (TAB)

N69-24560# Schwarzkopf Microanalytical Lab., Woodside, N.Y.
PROCEDURE FOR THE DETERMINATION OF OXYGEN IN FLUORO-ORGANIC COMPOUNDS Final Report, Jun. 1967–Apr. 1968
F. Schwarzkopf and O. Schwarzkopf Oct. 1968 35 p
(Contracts AF 33(615)-1565; F33615-67-C-1363)
(AD-680016; AFML-TR-68-176) Avail: CFSTI CSCL 7/4

A method for the determination of oxygen in fluoro-organic compounds has been developed. A quartz combustion tube is used with a nickel insert for the carbon filling and a nickel sleeve for the sample. It was shown that the pyrolysis products contain fluorine in the form of low molecular fluorocarbons and only insignificant amounts, if any, of HF. They are led directly from the Ni tube containing the carbon filling into the oxidizer tube without passing through a scrubber. As oxidizer only CuO at 200C was found suitable. The gas then passes through a washer, a drying train and into the CO2 absorber. Author (TAB)

N69-24565# Air Force Cambridge Research Labs., Bedford, Mass.
DETERMINATION OF OXYGEN CONTENT IN GERMANIUM AND SILICON BY He^3 ION ACTIVATION
G. I. Aleksandrova et al Sep. 1968 17 p refs Transl. into ENGLISH from Russian Rept.
(AD-680364; AFCRL-68-0458; Trans-15) Avail: CFSTI CSCL 7/5

In connection with the necessity of selecting a material suitable for the manufacture of spectrometric nuclear radiation detectors, a technique has been developed for oxygen determination in germanium and silicon by He3 ion bombardment. The possibility of analysis of gallium arsenide, tungsten, silicon carbide, and other materials is demonstrated. The sensitivity of the method is 0.0000007 percent. Author (TAB)

N69-24570# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ABSORPTION OF OXYGEN AT ELEVATED TEMPERATURES (300°–900°K) IN THE SCHUMANN-RUNGE SYSTEM, OCTOBER 1964-JUNE 1967
Robert D. Hudson and Virginia L. Carter Jul. 1968 93 p refs
(Contract F04701-68-C-0200)
(TR-0200(9260-01)-2; SAMSO-TR-68-452) Avail: CFSTI CSCL 7/4

The photoelectric spectrum of molecular oxygen has been recorded between 1750 and 2020 A at 300, 600, and 900 K at an instrumental bandwidth of 0.075 A. Over 1000 new lines have been observed, most of which have been identified as arising from the v = 1 and 2 levels of the X triplet Sigma(-) ground state. A modified curve-of-growth technique has been used to determine the oscillator strengths of the v = 0, 1, and 2; v = 5 to 13 bands. Estimates of the line widths have been obtained. TAB

N69-24885# Catholic Univ. of America, Washington, D. C. Dept. of Chemistry.
SPECTROSCOPIC AND STRUCTURAL STUDIES OF OXYANIONS OF TRANSITION METALS IN FUSED SALT MEDIA Final Report

J. B. Hunt and F. X. Maxwell 1968 17 p refs
(Contract N60921-7160(FBM))
(AD-680034) Avail: CFSTI CSCL 7/4

This report deals exclusively with the Raman spectroscopic investigations on the development of stable light sources for Raman spectroscopy, using electrical discharge. Mercury, thallium, indium, gallium, rubidium and lead were used in these lamps. TAB

N69-24600# Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry.
EXCITATION AND IONIZATION BY IONIZING RADIATIONS IN WATER AND AQUEOUS SOLUTIONS
Gabriel Stein [1968] 16 p refs Presented at 19th Farkas Mem. Symp., Jerusalem, Dec. 1967 Submitted for publication
(Contract AT(30-1)-3242)
(NYO-3242-25; Conf-671212-2) Avail: CFSTI

The evidence for excitation of water and aqueous solutions by ionizing radiations was surveyed. Light emission studies on aqueous systems were critically examined. Compared with many liquid organic systems, in liquid aqueous systems light emission and, in general, excited state formation, is low. Light emission originates from the lowest singlet excited states. In frozen aqueous systems total excited state formation and light emission increases and triplet states preponderate. The various mechanisms responsible for the observations: direct excitation, chemiluminescence from excited states resulting from radical addition processes, triplet formation from charge recombination, and quenching of excited states by radioinduced radicals were surveyed. Author (NSA)

N69-24638# Cekmece Nuclear Research Center, Istanbul (Turkey).
GAMMA IRRADIATION OF Δ^5-CHOLESTENE-3-ONE
Envare Uenseren Jan. 1969 21 p refs
(CNAEM-63) Avail: CFSTI

Irradiation of a solution of Δ^5-cholestene-3-one in ethyl alcohol with gamma rays at TR-1 gave a mixture of products depending on the nature of the solvent, the concentration of the solution, and the total gamma dose absorbed. From a 1% solution of Δ^5-cholestene-3-one in absolute ethyl alcohol upon irradiation with a total gamma dose of 10.3 Mrad, after chromatography on alumina, four reaction products, Δ^4-cholestene-3-one, Δ^4-cholestene-3, 6-dione, Δ^4-cholestene-6β-ol-3-one, and Δ^4-cholestent-7β-ol-3-one were isolated and identified in addition to the starting material. Irradiation of the same solution with a total gamma dose of 130 Mrad led to the formation of a dimer, 3,3'-bis-3,5-cholestadiene, and five more reaction products: Δ^4-cholestene-^{4} β-ol-3one ethyl ether, cholestane-3,6-dione, cholestane-5α, 6β-diol-3-one, Δ^4-cholestene-3β, 6β-diol, and Δ^5-cholestene-3β, 7β-diol. Author

N69-24646# Commissariat a l'Energie Atomique, Saclay (France).
CHEMICAL SEPARATION OF FISSION PRODUCTS
J. Lefevre 1968 25 p refs In FRENCH Presented at the 50th Anniv. of the Soc. of Industrial Chem., Paris, France
(CEA-Conf-1092-Conf-680539-1) Avail: AEC Depository Libraries

Chemical procedures were developed for the recovery of the fission isotopes, ^{137}Cs and ^{90}Sr. A procedure for the separation of cesium-137, which is being placed on an industrial pilot stage, is described. The procedure is based on the utilization of a "mixed exchanger," a mineral compound containing 80% by weight of zirconium phosphate and 20% ammonium phosphotungstate. Sr-90 can be separated either by liquid–liquid extraction using bis(2-ethylhexyl) phosphate or by ion exchange on antimonic acid. The rare earths, ^{147}Pm and ^{144}Ce, have been considered until now only as by-products of the separation of ^{90}Sr (by liquid–liquid extraction) or of the separation of the transuranium elements, Np and Am. Separation studies on these isotopes are only fragmentary. Author (NSA)

N69-24649# Technische Hochschule Munchen (West Germany). Fakultaet Fuer Allgemeine Wissenschaften.
THE DIRECT H-T AND H-D EXCHANGE REACTION ON ALKYL AROMATICS USING HYDROGENATION CATALYSTS [UEBER DIE DIREKTE H-T UND H-D-AUSTAUSCHREAKTION AN ALKYLAROMATEN UNTER VERWENDUNG VON HYDRIERUNGSKATALYSATOREN]
Manfred Baumeister (Ph.D. Thesis) 1968 17 p In GERMAN
Avail: CFSTI

The hydrogen exchange reaction with deuterium and tritium was studied to determine if the complex catalysts mechanism can be influenced by high-energy radiation. Organic substances with a number of different reactive hydrogen atoms were used as the exchange partners; the hydrogenation catalysts were of the commercial type. Activity measurements were performed by liquid-scintillation spectrometry, radioactive gas chromatography, mass spectrometry, and nuclear magnetic resonance. Reactions were analyzed in the liquid and gaseous phases, and the temperature dependence of the reactivity was determined. Transl. by K.W.

N69-24671# Wisconsin Univ., Madison. Dept. of Chemistry.
STRUCTURAL CHEMISTRY AND BONDING IN INORGANIC COMPOUNDS Final Report, 1 Oct. 1963–Sep. 1967
Lawrence F. Dahl Dec. 1968 8 p refs
(Contracts AF-AFOSR-518-64; AF-AFOSR-518-66)
(AD-680050; AFOSR-68-2843) Avail: CFSTI CSCL 7/2

Systematic structural investigations not only have led to the characterization of new general types of organometallic complexes but also have provided new structural and bonding principles. These investigations have included studies on a wide variety of unusual organo (transition metal sulfur complexes). It has been shown that a sulfur atom can function as a doubly-bridging two-electron donating group, a triply-bridging four-electron donating group, a quadruply bridging four-electron donating group, and a quadruply bridging six-electron donating group in organometallic complexes. This work has also uncovered the fact that disulfide groups can be coordinated to one, two, or four transition metals. In addition, several new kinds of metal atom cluster systems have been uncovered, and the importance of metal-metal interactions on the molecular geometries of polynuclear metal carbonyl and cyclopentadienyl complexes has been assessed for several complexes. A brief summary of this work is given. Author (TAB)

N69-24690# Atomics International, Canoga Park, Calif. Liquid Metal Engineering Center.
MECHANICAL ELEMENTS OPERATING IN SODIUM AND OTHER ALKALI METALS, VOLUME 1: LITERATURE SURVEY
J. K. Balkwill [1968] 120 p refs
(Contract AT(04-3)-700)
(LMEC-68-5(Vol-1)) Avail: CFSTI

A search was made of literature reporting information published since 1950 on mechanical devices with rubbing surfaces operating in alkali metals. Sodium environments are emphasized, with data also included from potassium, NaK, and lithium experiments. The characteristics of potentially useful materials that are important in liquid metal applications are discussed. Material compatibility and friction/wear testing programs conducted since 1950 are described. Experimental and operating experience with full-size components is presented. Author (NSA)

N69-24694# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ABOUT RADIATION PERTURBATIONS IN RADIOACTIVE AND GAMMA-IRRADIATED CALCIUM, STRONTIUM, AND BARIUM SULFATES SAMPLES

V. V. Gromov and L. Karaseval May 1968 8 p refs Transl. into ENGLISH from Radiats. Fiz. Akad. Nauk Latv. SSR (Riga), Vol. 4, 1966 p 49–52
(AD-680565; FTD-HT-23-2-68) Avail: CFSTI CSCL 7/5

Electron paramagnetic resonance was used to study the transformations occurring in a crystal lattice of Alkali-earth sulfates under the influence of beta radiation from 35S introduced into these compounds. Also investigated were nonradioactive samples of the same salts irradiated with gamma rays from 60Ca. The tests consisted essentially of determining the accumulation of paramagnetic centers in the radioactive sulfates, determining the concentration of the paramagnetic centers as a function of the specific radioactivity, and measuring the annealing of the paramagnetic centers in the irradiated sulfates. The results show that the higher the level of the specific radioactivity of the salt, the more rapidly equilibrium is attained in the formation of the paramagnetic centers. The paramagnetic-center concentration increases with radioactivity but eventually attains saturation. It is concluded from the results that irradiation produces in the investigated salts localized unpaired electrons, which remain stable up to certain temperatures. The most stable EPR signal is found to be due to the radical SO3(-). The asymmetry of the observed EPR line is attributed to the radical SO4(-), which has a three-axis anisotropy of paramagnetic susceptibility. TAB

N69-24711# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
RADIATION CHEMISTRY OF MONO-SUBSTITUTED AROMATIC COMPOUNDS Progress Report, 15 Jan. 1968–15 Jan. 1969
J. A. Knight, Jr. 27 Jan. 1969 21 p refs
(Contract AT(40-1)-3519)
(ORO-3519-3) Avail: CFSTI

Studies were initiated on the radiation chemistry of monosubstituted benzenes with nonhydrocarbon substituents. The first compounds to be studied were nitrobenzene, with an electron-attracting group, and aniline, with an electron-releasing group, with major emphasis on the radiolysis of nitrobenzene. Nitrobenzene was γ-irradiated at 30°C and 80°C and the major radiolytic products determined. Some irradiations at 30°C with DPPH were made. Relative reactivities for the radiolytic phenylation of nitrobenzene were obtained and compared with the free radical phenylation results. Data indicate that, in the radiolysis of nitrobenzene, processes other than phenylation of nitrobenzene by a phenyl free radical are also producing the isomeric nitrobiphenyls. Preliminary irradiations of aniline indicate that aniline is more radiation resistant than nitrobenzene. Hydrogen gas (G ≈ 0.11) and three isomeric aminobiphenyls, 2,2'-diaminobiphenyl, and diphenylamine were identified as radiolytic products. NSA

N69-24724# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
SELECTED TOPICS IN THE THEORY OF ATOMIC SPECTRA
H. Odabasi Nov. 1968 305 p refs
(AD-680470; JILA-97) Avail: Issuing Activity CSCL 7/4

The numerical procedure is outlined. The theoretical ionization potentials, term and level energies in SLJM and intermediate coupling scheme, for the five lowest lying configurations of silicon, phosphorus and sulfur isoelectronic sequences are calculated using non-relativistic Hartree-Fock-Slater basis sets. In the process of evaluation different interactions are added one at a time to give an idea of their effects. At each step the theoretical results are compared with the observed ones. To exhibit the mixing of terms or levels for typical cases the mixing coefficients, as defined in the text, are tabulated. In the beryllium isoelectronic sequence, with the exception of Be I and B II, the observations show that the 2s3p (3)P term lies higher than 2s3p (1)P term, contrary to the theoretical expectation. This fact is explained by configuration mixing. Other configuration mixing calculations are carried out for the 3p4p (3)D, (3)P, (3)S, (1)D, (1)P and (1)S terms in the silicon isoelectronic sequence. The behavior of line strengths in the extreme mixing of the levels due to spin-orbit interaction is shown by calculating intermediate coupling line strengths for 3s-3p and 3p-3d transitions in the carbon isoelectronic sequence. Author (TAB)

N69-24737# Western Reserve Univ., Cleveland, Ohio. Ultrasonics Research Lab.
PRESSURE SHOCK TECHNIQUE FOR THE STUDY OF CHEMICAL RELAXATION
Heinz Hoffmann and Ernest Yeager Mar. 1968 23 p refs
(Contract Nonr-1439(04))
(AD-680267; TR-33) Avail: CFSTI CSCL 7/4

The pressure shock technique with a conductivity readout has been demonstrated to be a relatively simple means for the measurement of relaxation times for chemical processes in the range 0.001 to 0.000001 sec. The apparatus described and its performance illustrated for ionic association-dissociation processes. Author (TAB)

N69-24742# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
ON THE PHASE TRANSITION IN SOLID HYDROGEN Research Communication No. 74
John C. Raich and Richard D. Etters Oct. 1968 32 p refs
(AD-680672; DAC-Paper-5234) Avail: CFSTI CSCL 7/4

The phase transition in solid hydrogen is examined with a simple Ising-type model used for the intermolecular interactions. A statistical treatment based on Bethes method is used. For pure ortho-hydrogen, no abrupt transition between the orientationally ordered and disordered phases is found, but the molecular field approximation gives a first-order transition. In addition, the concentration dependence of the actual fcc-hcp transition temperature is interpreted in terms of this model. Author (TAB)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N69-23382 Colorado Univ., Boulder.
BINARY COMMUNICATIONS THROUGH ATMOSPHERIC NOISE
Alexandre Gomes Cerveira (Ph.D. Thesis) 1968 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-14373

This work presents a specific problem of optimization of binary communications through a radio channel affected by lightning or atmospheric noise. In the solution a model of impulsive noise is used, and therefore noise is of a nongaussian type. Moreover, the operation of the radio channel is such that noise and message signals are nonadditive. A performance index which depends linearly on the probabilities of error and on the transmitted waveform characteristics is used in the optimization of the link. The optimization affects both the structure of the receiver and the structure of the transmitter. For the receiver a type of correlation detector is obtained, and for the transmitter a wave-shaping circuit must be used for generating the pulses sent into the radio channel. The solution is partially obtained by means of a computer. Dissert. Abstr.

N69-23398 North Carolina State Univ., Raleigh.
A SCATTERING APPROACH FOR DETERMINING THE CHARACTERISTICS OF A DIELECTRIC ANTENNA OF ARBITRARY SHAPE
Johng Ryun Kim (Ph.D. Thesis) 1968 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-14662

The problem of the omnidirectional dielectric antenna is taken as a scattering problem. The Stratton and Chu formula is applied in conjunction with the concept of polarization volume current and charge densities. Fictitious surface charge densities are introduced to compensate for discontinuities of the field at the interface of the dielectric and free space. An integral equation is established for the electric field within the volume and on the enclosing surface of the dielectric. A method involving an equivalent spherical cell is developed to solve the integral equation numerically. A large set of simultaneous linear algebraic equations are obtained for the field in the dielectric, and it is solved by a partition technique. The radiation pattern, radiation resistance, dielectric loss, directivity and gain of the antenna are determined based on the near field obtained by the volume cell technique. These theoretical results agree very closely with the experiments. Dissert. Abstr.

N69-23404 Virginia Polytechnic Inst., Blacksburg.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF A FREQUENCY-SHIFT-KEYED SIGNAL GENERATED BY A PHASE-LOCKED-LOOP WITH APPLICATION TO NARROWBAND FSK
Thomas Hunter Gee (Ph.D. Thesis) 1968 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-12653

The investigation is concerned with the characterization of phase-locked-loop (PLL) output signal (exhibiting a finite frequency transition interval). Expressions are obtained for the output signal and the resulting modulation waveform for the case of a single frequency shift. Graphical evidence of the dependence of the modulation waveform on the loop parameters, gain and bandwidth, is presented. In order to facilitate the analysis of linear networks excited by the frequency shift (FS)-PLL, an infinite series of damped sinusoidal terms, representing the PLL output signal is developed. This series is also utilized to determine the coefficients of the Fourier series representation of a periodically keyed PLL. Using this result, the signal bandwidth is shown to vary directly as the loop bandwidth. Application of the FS-PLL as a voltage source is made in the case of the equivalent circuit (a high Q series tuned circuit) of a VLF transmitting antenna. Dissert. Abstr.

N69-23411*# SFD Labs., Inc., Union, N. J.
ANALYTIC DESIGN OF SPACEBORNE AXIAL INJECTION CROSS-FIELD AMPLIFIERS Final Report
G. Bernstein and W. C. Sylvernal 30 Sep. 1968 265 p refs
(Contract NAS3-11516)
(NASA-CR-72393; SFD-54003-F) Avail: CFSTI CSCL 09E

Theoretical designs are given for a UHF and an S band crossed-field amplifier suitable for use in a satellite television relay system. The mode of modulation considered is vestigial side band AM. A new form of crossed-field amplifier, the axial injection CFA, is presented. This form of amplifier will be able to meet the system requirements for high efficiency, wide dynamic range, low noise, and a minimum life of 20,000 hours. In addition, this new type of amplifier is capable of maintaining a high level of efficiency at power levels well below peak synchronizing power, resulting in high average efficiency. Author

N69-23416*# ADCOM Inc., Cambridge, Mass.
STUDY OF PIONEER SPACECRAFT OSCILLATOR STABILITY Final Report
Howard Salwen Nov. 1968 41 p refs
(Contract NAS2-5021)
(NASA-CR-73307; G-139) Avail: CFSTI CSCL 17B

The effect of oscillator instability on coherent demodulator performance is discussed. Oscillator instability is characterized; the relationship between oscillator instability and coherent demodulator performance is established, and estimates of carrier lock error due to oscillator instabilities in the Pioneer system are presented. An experimental method for measuring oscillator short term stability is described. An analysis is given concerning the effect of carrier unlock on bit error probability. The results of the study program are summarized, and conclusions and recommendations are presented. Author

N69-23435*# Ohio State Univ., Columbus. ElectroScience Lab.
RADAR AND MICROWAVE RADIOMETRIC TECHNIQUES FOR GEOSCIENCE EXPERIMENTS
T. L. Oliver and W. H. Peake 13 Feb. 1969 320 p
(Contracts NSR-36-008-027; F33615-67-C-1663)
(NASA-CR-100670; Rept-1903-9) Avail: CFSTI CSCL 17I

Measurements of the normalized backscattering cross sections of a number of agricultural surfaces are reported for microwave frequencies of 1.8, 10, 15, and 35 GHz. The surfaces include wheat, oats, soybeans, sudan grass, corn, alfalfa, and sorghum. Ground truth data including, for instance, surface location, crop variety and moisture, soil moisture, etc. are provided for most surfaces. Author

N69-23539*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CALCULATION OF ANTENNA RADIATION PATTERNS BY A VECTOR THEORY USING DIGITAL COMPUTERS
Richard F. Schmidt Aug. 1968 20 p *ref*
(NASA-TM-X-63523; X-525-68-315) Avail: CFSTI CSCL 09E

This document continues with the application of field equations to the solution of antenna problems. The electric and magnetic fields at the reflector boundary after reflection are related to the incident fields via the boundary conditions. It is shown that the evaluation of the scattered radiation pattern can be accomplished in an efficient manner by converting electric field terms to their magnetic equivalents and utilizing only a simple magnetic polarization vector. The history of the wave emanating from the prime-feed source is next written into the formulation explicitly, but without introducing a specific illumination function. A generally-applicable technique for accommodating feed translation and rotation with six degrees of freedom is then developed for numerical integration of the field equations. An appendix containing the subroutines for surface normal and differential area of the set of conic surfaces (paraboloid, hyperboloid, ellipsoid, sphere, and cone) is included so that this document provides the means for evaluating a large class of antenna configurations. Author

N69-23563# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
DISTANCE MEASURING EQUIPMENT FOR TERMINAL AREA Final Report
Charles J. Hirsch Mar. 1969 51 p refs
(SRDS-RD-69-21) Avail: Issuing Activity

Results are reported of an investigation of the course of action to be taken by the Federal Aviation Administration to optimize the configuration, performance, and implementation of DME ground transponders for use as terminal area navigational aids, particularly when associated with TVOR and ILS. It includes the determination of the characteristics of a low power, low cost transponder and discusses its behavior in the terminal area and its relationship to other DME's. Author

N69-23842*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PARAMETRIC ANALYSIS OF MICROWAVE AND LASER SYSTEMS FOR COMMUNICATION AND TRACKING: A SUMMARY

F. Kalil Washington Apr. 1969 97 p refs

(NASA-TR-R-309) Avail: CFSTI CSCL 17B

A comparative analysis was made of laser and microwave telecommunication systems for space applications. Parametric families of curves are presented that give the weights and telecommunications capabilities of spaceborne communication systems. These curves permit the mission planner and designer to compare various sytems and select the one that best meets their requirements. A sample case demonstrates the use of these curves. The sample calculation and concluding remarks point out the advantages of a computerized method that uses the calculus of maxima and minima for selecting the optimum spaceborne communication system configuration that can provide the specified information rate for the least spaceborne weight penalty and/or cost. Author

N69-23848 Rensselaer Polytechnic Inst., Troy, N. Y.

MICROWAVE TRANSMISSION PHASE CONTROL WITH ELECTRONIC BULK CONDUCTIVITY MODULATION OF SILICON OBSTACLES IN WAVEGUIDE

Joseph F. White (Ph.D. Thesis) 1968 127 p

Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-13529

This study was made to determine suitable methods for achieving high power microwave phase control using semiconductor switching techniques. Both the microwave circuitry as well as the semiconductor control elements were studied. It was found that a transmission line loaded by spaced, switchable susceptances forms a practical and readily analyzable circuit by which the phase shift function can be divided among as many semiconductor elements as are needed for a given level of microwave power operation. With this approach a device yielding 200 degrees of phase shift per decibel of insertion loss was built using conventional switching diodes and operated to 15 kilowatts of peak power at 3 gigahertz. Dissert. Abstr.

N69-23890# Rome Univ. (Italy).

SOLUTION OF THE DISCONTINUITY PROBLEM BETWEEN AN EMPTY RECTANGULAR WAVEGUIDE AND THE SAME GUIDE COMPLETELY FILLED WITH TRANSVERSELY MAGNETISED FERRITE

Giorgio Gerosa Jun. 1967 12 p refs

(Contract AF 61(052)-807)

(AD-678884; AFCRL-67-0507; SR-4) Avail: CFSTI CSCL 20/14

The solution found by other authors for the discontinuity problem between an empty rectangular waveguide and the same guide completely filled with transversely magnetized ferrite, solution which fails for a certain range of the ferrite parameters, has been modified by introducing a ferrite-metal surface wave, in order to obtain the correct solution. Author (TAB)

N69-23892*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

PERFORMANCE CHARACTERISTICS OF THE APOLLO ASTRONAUT BACKPACK ANTENNA

Jefferson F. Lindsey, III Washington May 1969 22 p refs

(NASA-TN-D-5081) Avail: CFSTI CSCL 09E

Antenna patterns and voltage-standing-wave ratio measurements were made, including both surface reflection effects and free space data. The antenna pattern data were taken at frequencies of 259.7, 279.0, and 296.8 megahertz, with surface reflection effects included. The voltage standing wave ratio in this range were under 2.0:1, and the gains with surface reflection effects and the astronaut standing ranged from the worst case null of −5 decibels at 259.7 megahertz to +2 decibels at 279.0 megahertz. In the bending over and lying down positions, the gains range from −28 to +1 decibels. As a result, no height gain correction factor in the transmission loss is required in the circuit margin calculations for the bending over and lying down positions. Author

N69-23938# Institute for Defense Analyses, Arlington, Va. Systems Evaluation Div.

APPLICATION OF COMMUNICATION SATELLITES TO THE MILITARY COMMAND STRUCTURE

Thomas G. Belden and Jay Schwartz Jan. 1969 25 p refs

(Contract DAHC15-67-C-0011)

(AD-680597; RP-P-371) Avail: CFSTI CSCL 17/2.1

Communication satellites (COMSATs) promise to have a great impact on military communications, and the difficulty in deciding the who and the how in their use has been evident to system planners from the first considerations of this new technology. The purpose of this paper is to call attention to particular advantages which COMSATs offer to meet peculiar needs in times of national emergency, and to suggest that the specific needs of joint commands should be given more attention in the planning of military COMSAT programs. Author (TAB)

N69-23961*# Communications and Systems, Inc., Falls Church, Va.

PROCEEDINGS OF THE GEOS PROGRAM REVIEW MEETING. VOLUME 3: TRACKING INTERCOMPARISON TESTS WITH GEOS-1

Feb. 1968 348 p Meeting held at Washington, 12–14 Dec. 1967

(Contract NASw-1503)

(NASA-CR-100662) Avail: CFSTI CSCL 17H

CONTENTS:

1. GEOS-A SHORT ARC OPTICAL SURVEY OF A SIXTEEN STATION MID-NORTH AMERICAN NET D. C. Brown (Brown (D.) Assoc., Inc.) p 1–20 (See N69-23962 12-07)

2. VARIATIONS IN THE MATHEMATICAL MODELING FOR GEOS-A J. G. Hartwell (Brown (D.) Assoc., Inc.) p 21–52 (See N69-23963 12-30)

3. GEODETIC DATA ADJUSTMENT PROGRAM J. J. Lynn (Brown (D.) Assoc., Inc.) p 53–58 (See N69-23964 12-08)

4. LASER/GRARR COLLOCATION EXPERIMENT P. A. Maresca (RCA Ser. Co., Inc.) p 59–64 (See N69-23965 12-16)

5. GRAVITY MODEL COMPARISON USING GEOS-1 LONG ARC ORBITAL SOLUTIONS F. J. Lerch, J. G. Marsh (NASA, Goddard Space Flight Center), and B. O'Neill (Wolf Res. and Develop. Corp.) p 65–145 (See N69-23966 12-30)

6. THE DETERMINATION AND COMPARISONS OF THE GRARR MADGAR SITE LOCATION F. J. Lerch, C. E. Doll (NASA, Goddard Space Flight Center), S. J. Moss, and B. O'Neill (Wolf Res. and Develop. Corp.) p 147–188 (See N69-23967 12-30)

7. EVALUATION OF THE GODDARD RANGE AND RANGE RATE SYSTEM AT ROSMAN BY INTERCOMPARISON WITH GEOS-1 LONG ARC ORBITAL SOLUTIONS F. J. Lerch, J. G. Marsh (NASA, Goddard Space Flight Center), and B. O'Neill (Wolf Res. and Develop. Corp.) p 189–262 (See N69-23968 12-07)

8. INTERCOMPARISON OF THE MINITRACK AND OPTICAL TRACKING NETWORKS USING GEOS-1 LONG ARC ORBITAL SOLUTIONS, PART 1 F. J. Lerch, J. G. Marsh, R. J. Sandifer, and W. A. Taylor (NASA, Goddard Space Flight Center) p 263–285 (See N69-23969 12-07)

9. AN INTERCOMPARISON OF SOME RESULTS FROM GEOS-1 DATA BASED UPON SECOR SHORT ARC vs OPTICAL LONG ARC REFERENCE ORBITS F. J. Lerch, J. G. Marsh (NASA, Goddard Space Flight Center), S. J. Moss, B. O'Neill (Wolf Res. and Develop. Corp.) p 287–369 (See N69-23970 12-07)

10. REFRACTION CORRECTION INTERCOMPARISONS. GEODETIC INVESTIGATIONS AT GSFC H. C. Parker (RCA Ser. Co., Inc.) p 371–388 (See N69-23971 12-13)

N69-23962*# Brown (D.) Associates, Inc., Melbourne, Fla.

GEOS: A SHORT ARC OPTICAL SURVEY OF A SIXTEEN STATION MID-NORTH AMERICAN NET

Duane C. Brown *In* Commun. and Systems, Inc. Proc. of the GEOS Program Rev. Meeting, Vol. 3 Feb. 1968 p 1–20 (See N69-23961 12-07)
(Contract NAS5-9938)
Avail: CFSTI CSCL 17H

A simultaneous adjustment of 16 camera sites in and about North America was performed by means of the GEOS Data Adjustment Program (GDAP). The program was exercised in the multi-pass or NEO-EMBET (N Epoch Orbital-Error Model Best Estimate of Trajectory) mode in which the initial conditions for a total of 24 selected orbits were recovered simultaneously with the coordinates of the optical tracking stations. Ground traces of the observed portions of the various satellite passes relative to the camera sites are presented. The observed number of flashes per station per pass is tabulated. Detailed observational coverage for four specific passes is indicated. Two separate computer reductions were performed in which the origin of the net was arbitrarily established at the camera site at Goddard, the coordinates of Goddard on the Cape Canaveral Datum being held fixed. Key results of the adjustments are presented. The reductions provide a survey accuracy to about 3 to 5 meters, suitable as an interim survey for GEOS A short arc tracking intercomparisons. Author

N69-23968*# Wolf Research and Development Corp., Bladensburg, Md. Applied Sciences Dept.

EVALUATION OF THE GODDARD RANGE AND RANGE RATE AT ROSMAN BY INTERCOMPARISON WITH GEOS-1 LONG ARC ORBITAL SOLUTIONS

Francis J. Lerch (NASA, Goddard Space Flight Center), James G. Marsh (NASA, Goddard Space Flight Center), and Brian O'Neill *In* Commun. and Systems, Inc. Proc. of the GEOS Program Rev. Meeting, Vol. 3 Feb. 1968 p 189–262 (See N69-23961 12-07)
(Contract NAS5-9756)
Avail: CFSTI CSCL 17H

Range measurements of the Goddard Range and Range (GRARR) tracking system at Rosman, N. C., are evaluated. Optical reference orbits were taken as a standard for comparing the accuracy of the range measurements. The optical reference orbits utilized GEOS-1 flash sequence data sets and some optical passive data from five major geodetic optical tracking networks. The networks and camera types consisted of the SAO-Baker-Nunn, GSFC STADAN and SPEOPT MOTS 40" and 24", USAF PC-1000, and the US C&GS BC-4. All 30 GRARR passes from the GEOS-1 satellite during two periods in January 1966 were evaluated. The observed range measurements were compared with values calculated from the optically determined reference orbits. For each pass, zero-set errors, timing errors, and random errors were estimated from the residual differences between the observed and calculated ranges. A summary of the zero-set and timing error estimates is presented for the two periods considered both separately and combined. Author

N69-23969*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

INTERCOMPARISON OF THE MINITRACK AND OPTICAL TRACKING NETWORKS USING GEOS-1 LONG ARC ORBITAL SOLUTIONS, PART 1

F. J. Lerch, J. G. Marsh, R. J. Sandifer, and W. A. Taylor *In* Commun. and Systems, Inc. Proc. of the GEOS Program Rev. Meeting, Vol. 3 Feb. 1968 p 263–285 (See N69-23961 12-07)
(X-552-67) Avail: CFSTI CSCL 17H

This paper presents one particular phase of a capability evaluation of the Minitrack tracking system based on optical observations of a GEOS 1 long arc trajectory. The Minitrack data were analyzed before correction for refraction and other effects. The geometry of the Minitrack antenna reception pattern and the method of tracking suggest that it may be possible to extract the relative effect on the residuals of those phenomena which are not refraction dependent. These data as obtained from the NASA Space Science Data Center consist of 1 to 3 observation pairs of direction cosines per station pass and were transformed by polynomial smoothing. The data were reduced by Goddard from approximately 30 observation pairs of phase difference measurements per station/pass as transmitted to Goddard by the tracking station. Author

N69-23970*# Wolf Research and Development Corp., Bladensburg, Md. Applied Sciences Dept.

AN INTERCOMPARISON OF SOME RESULTS FROM GEOS-1 DATA BASED ON SECOR SHORT ARC vs OPTICAL LONG ARC REFERENCE ORBITS

Francis J. Lerch (NASA, Goddard Space Flight Center), James G. Marsh (NASA, Goddard Space Flight Center), Samuel J. Moss, and Brian O'Neill *In* Commun. and Systems, Inc. Proc. of the GEOS Program Rev. Meeting, Vol. 3 Feb. 1968 p 287–369 (See N69-23961 12-07)
(Contract NAS5-9756)
Avail: CFSTI CSCL 17H

Some results of the evaluation of the range measurements from the U.S. Army SECOR tracking system are presented. The data were taken on the GEOS-1 satellite by stations in the Eastern United States, at Herndon, Va., Greenville, Miss., Homestead, Fla. and Ft. Stewart, Ga., in the period December 31, 1965 to January 5, 1966. Optical reference orbits were taken as a standard for this evaluation and compared with results obtained using SECOR short arcs as reference. The optical reference orbits utilized GEOS-1 flash sequence data and some passive observations from five major geodetic optical tracking networks. The networks and camera types consisted of the SAO Baker-Nunn, the GSFC STADAN and SPEOPT MOTS 40" and 24", USAF PC-1000, and the U.S.C. and G.S. BC-4. The SECOR data consisted of 14 station passes during four "quad" passes over the United States. Simultaneous data from the Goddard range and range rate system (GRARR) were also available during these four passes, affording the opportunity to intercompare the evaluation of this instrument based on an optical reference orbit with earlier results. Author

N69-24039# Joint Publications Research Service, Washington, D. C.

POSSIBLE USE OF THE GRAPHECON IN THE INFORMATION-TRANSMISSION SYSTEMS OF COASTAL RADAR STATIONS

Va. A. Vasilenko et al 7 Apr. 1969 10 p refs Transl. into ENGLISH from Tr. Tsentr. Nauchn.-issled. Inst. Morsk. Flot (Leningrad), no. 91, 1968 p 41–49
(JPRS-47791) Avail: CFSTI

The increased interest in the utilization of the storage-type cathode-ray tubes (CRT) in the radarscopes of radar stations is explained by the possibility of eliminating with their aid certain shortcomings inherent to the CRT-type indicators with afterglow.

The storage-type CRT permit us to obtain a controllable memory at high clarity, thereby enhancing the working conditions of the operators. As an example, we can cite the utilization of the storage CRT of the graphecon type for displaying radar information on the TV screens in the centers for controlling air motion. Author

N69-24040# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIENCE IN TECHNICAL INNOVATION: METHOD OF DIPLEXER DESIGN

Ts'Ai Chen-Yuan Jul. 1968 10 p Transl. into ENGLISH from Tien Tzu Chi Shu (Peking), no. 2, 1966 p 29–30

(AD-682459; FTD-HT-23-1673-67) Avail: CFSTI CSCL 9/5

The author describes a design for a common antenna used for two radio transmitters. According to transmission line theory, one antenna may be used for two transmitters simultaneously operating on three different wavelengths by employing a crossed filter-network. The filter-network consists of half-wave and quarter-wave transmission-line elements which present different characteristic impedances for different frequencies. Thus, signals of desired frequencies can pass through the filter-network, and signals of undesirable frequencies are blocked. The length of transmission-line elements can be determined, and a feeder having characteristic impedance W = 600 ohm may be used for connecting the common antenna to the two transmitters. In antenna installation, transmission line elements in return circuits A, B, and C must be perpendicular to the feeder, and their shorted ends should be soldered and have good contact. To reduce the power loss, the transmission-line elements are made with copper conductors of 4-6 mm diameter. The author concludes that the crossed filter network is suitable only for a transmitting power below 25 kw. TAB

N69-24051*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

FIRST-ORDER SOLUTIONS FOR MUTUAL COUPLING BETWEEN WAVEGUIDES WHICH PROPAGATE TWO ORTHOGONAL MODES

R. J. Mailloux Washington May 1969 26 p refs

(NASA-TN-D-5180) Avail: CFSTI CSCL 17B

A theoretical and experimental study of closely spaced open-ended waveguides radiating through a conducting ground plane is described. The waveguides are large enough in some cases to allow two orthogonally polarized propagating modes in each waveguide. A first-order analysis is presented which is based upon the method of moments and uses of a single-mode approximation to the aperture field for each polarization. An improved first–order analysis is also presented which uses a higher order mode solution for the self admittances. Close agreement with experiment is demonstrated. Author

N69-24052*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMPUTED RADIATION PATTERNS OF A THERMALLY DISTORTED 30-FOOT ATS F AND G PARABOLIC REFLECTOR ANTENNA

Richard F. Schmidt Nov. 1968 15 p refs

(NASA-TM-X-63401; X-525-68-428) Avail: CFSTI CSCL 09F

Farfield radiation patterns of a thermally distorted ATS F and G 30-foot antenna are computed at 2 GHz and 8 GHz by an IBM 360 Mod. 91 computer using a second-order polynomial representation of the antenna surface. Radiation patterns of the undistorted reflector are included to establish a basis for comparison, and the effect of improper feed positioning is investigated. Author

N69-24053*# General Electric Co., Schenectady, N. Y. Research and Development Center.

ATS RANGING AND POSITION FIXING EXPERIMENT, 25 NOVEMBER 1968–25 AUGUST 1969 Quarterly Report [1969] 52 p

(Contract NAS5-11634)

(NASA-CR-100732; S-69-1040; QR-1) Avail: CFSTI CSCL 17B

The measurement parameters for the ranging and position fixing equipment were confirmed. The bandwidth to be tested is compatible with mobile communications, and has a modulation bandwidth of 2.4414 kHz and a radio frequency of approximately 15 kHz. Equipment designs were confirmed and the following equipments were constructed: a tone-code signal generator, a phase matcher-correlator, and a responder unit for installation in a mobile van. A similar responder unit has been constructed previously for installation in the Sea Robin buoy that is to be tested near Bermuda. Construction was started on a responder unit intended for integration with a transmitter and receiver to be furnished by the FAA for flight tests during the second quarter of the experiment. The units employ integrated circuits and are fabricated on printed circuit boards. Range measurements were made from the Radio-Optical Observatory near Schenectady, New York to satellites ATS-1 and ATS-3, and through ATS-3 to the Sea Robin unit at Bermuda and to the mobile van at Schenectady. Observations based on the data that has been processed are included in the appendix of this report. Author

N69-24054*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE CALCULATION OF ANTENNA RADIATION PATTERNS BY A VECTOR THEORY USING DIGITAL COMPUTERS

Richard F. Schmidt Jun. 1968 29 p refs

(NASA-TM-X-63253; X-525-68-201) Avail: CFSTI CSCL 20N

This document reviews the Kirchhoff-Huygens-Fresnel theory of diffraction, including Kottler boundary correction, and discusses the reduction of this formulation for the special case of metallic reflectors with unbounded conductivity. The formal transition from the scalar to the vector case is given in detail. Radial and transverse field components are identified, the entry of the near-field terms is discussed, and the physical quantities (sheet current, charge distribution, etc.) associated with the mathematical development are presented through a simple dimensional analysis. The analytic aspects of the problem are considered, and the points of departure from conventional analysis to numerical methods and digital computation are outlined. Author

N69-24059*# Ohio State Univ., Columbus.

THE Te-01 MODE REFLECTION COEFFICIENT OF A GROUND-PLANE MOUNTED PARALLEL-PLATE WAVEGUIDE ILLUMINATING A REFLECTING SHEET

L. L. Tsai and R. C. Rudduck Washington NASA May 1969 27 p refs

(Grant NGR-36-008-005)

(NASA-CR-1327; TR-1691-30) Avail: CFSTI CSCL 17B

The TE_{01} mode reflection coefficient is analyzed for a symmetric parallel-plate waveguide terminated in a ground plane and radiating into a perfectly reflecting sheet oriented normal to the guide axis. The method of analysis and calculated results are similar to those of the TEM mode analysis. The transmission between two identical waveguides facing each other is also analyzed. Author

N69-24088*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.

A 10.6-MICRON OPTICAL HETERODYNE COMMUNICATION SYSTEM Final Report, 1 Jun. 1967–15 Jun. 1968

Hans W. Mocker Sep. 1968 118 p refs
(Contract NAS8-20645)
(NASA-CR-98115; Rept-12044-FR2) Avail: CFSTI CSCL 17B

A 10.6-micron optical heterodyne communication system is described that uses two stable single-mode and single-frequency CO_2 lasers of high frequency stability. Wavelength control on both lasers allows use of one and the same transition of the rotation-vibration band of CO_2 around 10.6 microns. The lasers oscillate at a power level of 5 watts with a diffraction-limited beam spread of 5 mradians. An automatic frequency control loop keeps both lasers locked in frequency with a 10-MHz offset. A frequency stability of 1 part in 10^{10} and a tracking accuracy of 2 parts in 10^{11} has been demonstrated. The system has a bandwidth of 1 MHz, and simultaneous operation in baseband and on a 50-kHz carrier has been achieved. Heterodyne detection with mercury-cadmium-telluride detectors yielded signal-to-noise ratios within 3db of the photon noise limit. Author

N69-24128*# Volt Information Sciences, Inc., Washington, D. C.
PROPAGATION OF ULTRA-SHORT WAVES IN THE ATMOSPHERE OF VENUS
O. P. Yakovlev et al Greenbelt, Md. NASA. Goddard Space Flight Center 5 May 1968 213 p refs Transl. into ENGLISH from Radiotekhn. i Elektron. (Moscow), v. 15, no. 4, 1969 p 579–586
(Contract NAS5-12487)
(NASA-CR-100754; ST-PA-RWP-10831) Avail: CFSTI CSCL 17B

The results are presented of the analysis of decimeter and centimeter radiowave propagation in the atmosphere of Venus. The angles of refraction and the refractional attenuation of radiowaves are found. The fluctuations of field strength and the attenuation of the energy flux of radiowaves are analyzed. Author

N69-24178# National Bureau of Standards, Boulder, Colo. Radio Standards Engineering Div.
CALIBRATION PRINCIPLES AND PROCEDURES FOR FIELD STRENGTH METERS 30 (HZ TO GHz)
Harold E. Taggart and John L. Workman Mar. 1969 157 p refs
(Contract AF 30(602)-4383)
(NBS-TN-370) Avail: SOD $1.25

The National Bureau of Standards techniques of calibrating field strength meters and their related antennas are discussed. The standard field method and the injection method of calibrating loop antennas are given and the standard antenna method of calibrating dipole antennas is fully described. Measurement uncertainties of various methods are discussed. Author

N69-24218# Sandia Corp., Albuquerque, N. Mex.
ON RADAR PULSE SCATTERING FROM NONHOMOGENEOUS IONIZED MEDIA
Charles W. Harrison, Jr. and Eugene A. Aronsond Aug. 1968 29 p Sponsored by AEC
(SC-R-68-1874) Avail: CFSTI

A review is presented of some of the preliminary work carried out at the Sandia Laboratories relating to pulse radar from ionized media, such as fireballs resulting from nuclear explosions and the wakes of high-speed re-entry vehicles. In all cases the objective was to retrieve the envelope of the back-scattered signal correctly related in time to the transmitted pulse, and employ a suitable form of the radar equation to obtain the power available in the receiver load in terms of the transmitter power. The electron density-collision frequency profiles used were based on the efforts of others. In the work completed, the region near the virtual reflection point in the profile was divided into at least 40 slabs which were considered to be infinite in two dimensions and generally of differing widths. In the solution of the boundary value problem in the frequency domain Maxwell's equations were satisfied at every interface. Piecewise constant zoning was used initially. A computer was employed to invert the matrix for determining the reflection coefficient for a given profile. Author (NSA)

N69-24248# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.
NUMERIC DISPLAYS FOR DYNAMIC INFORMATION PRESENTATION
John M. Rolfe *In* AGARD Prob. of the Cockpit Environ. Nov. 1968 2 p refs (See N69-24230 12-02)
Avail: CFSTI

The value of displaying information in direct numeric terms, rather than in the form of the position of a pointer on a dial, is considered. Experiments which examined numeric displays as part of a closed loop tracking system indicated that numeric displays can provide sufficient information but are less efficient than other displays, and that parity of performance is achieved at the expense of increased effort on the part of the subjects. A deterioration is shown in the subjects' ability to perform other tasks at the same time as the task involving the numeric display. P.A.B.

N69-24251# Compagnie Generale de Telegraphie sans Fil, Paris (France). Applications Radar Dept.
ELABORATION AND PRESENTATION OF INFORMATION ON LANDING [ELABORATION ET PRESENTATION D'INFORMATIONS D'AIDE A L'ATTERRISAGE]
M. J. Jullien *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 3 p In FRENCH (See N69-24230 12-02)
Avail: CFSTI

A solution for aiding the pilot of a modern airplane in poor visibility landings includes the elaboration of piloting orders and the presentation of these orders and complementary information in a form directly utilizable to the pilot. The solution is most applicable to military aircraft equipped with interception radar and civil aircraft equipped with meteorological radar. The way in which the facts are furnished and the orders are elaborated is discussed. Presentations are executed by a collimator which forms an image to infinity across the windscreen. These images are mechanically realized by luminous mobile reticles. Synthetic presentation of orders with and without exterior reference is discussed, the former allowing the orders-to-visual transition to be less difficult. Transl. by P.A.B.

N69-24311*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena Space Sciences Div.
MARINER 5 DUAL-FREQUENCY RECEIVER
David P. Martin 15 Apr. 1969 26 p refs
(Contract NAS7-100)
(NASA-CR-100761; JPL-TR-32-1375) Copyright. Avail: CFSTI CSCL 09E

This report summarizes the development and performance of the dual-frequency receiver (DFR), an instrument which was used in one of the science experiments on the *Mariner 5* mission to Venus in 1967. The objective of the experiment was to measure the effects of the ionosphere and atmosphere of Venus on the radio waves received by the DFR as the spacecraft occulted the planet. The experiment method and equipment are described. The development tests and some of the problems encountered are discussed, and the flight performance is summarized. Author

N69-24312# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DECREASING THE EFFECT OF 'BLIND ALTITUDES' IN RADAR PATH VELOCITY MEASUREMENT DEVICES

M. B. Tenin Mar. 1968 14 p refs Transl. into ENGLISH from Aviats. Inst. Teoriya i Tekhn. Radiol. (Moscow), no. 41, 1966 p 65–77
(AD-682775; FTD-HT-23-1479-67) Avail: CFSTI CSCL 17/9

The technique of wobbulating the pulse repetition rate to eliminate the undesirable effect of blind heights is analyzed as it applies to pulsed Doppler radars which are used to determine ground speed and which incorporate high pulse repetition rates and a low ratio of pulse interval to pulse width. An analysis has been carried out to determine the variation in the fundamental frequency of the received signal as a function of its delay time when a small percentage of wobbulation is used. For the sake of simplicity, the analysis uses the video frequency and assumes that the variations in the intensity of the received signal are similar to the variations in the dc component of the envelope for the video pulses. It is shown that the effect of blind heights can be substantially reduced and the basic frequency in the spectrum of the output signal can be made constant. Optimum values for the percentage wobbulation are derived for the case of a harmonic law and a non-symmetric saw-tooth law. The use of the non-symmetric saw-tooth law for wobbulation is recommended for practical purposes. TAB

N69-24323*# Radio Corp. of America, New York.
HELICAL COAXIAL RESONATOR RF FILTER
Myron Walter Maxwell, inventor (to NASA) Issued 8 Apr. 1969 (Filed 20 Jan. 1966) 4 p Cl. 333–73
(NASA-Case-XGS-2816; US-Patent-3,437,959; US-Patent-Appl-SN-521998) Avail: US Patent Office CSCL 09A

A narrow band RF filter is disclosed for shunting a plurality of undesired narrow bands of frequencies out of a transmission line. It uses a novel helically wound coaxial resonator with a plurality of winding mounted upon a tunable core. Official Gazette of the U.S. Patent Office

N69-24327# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ELECTROMAGNETIC INTERFERENCE MEASUREMENT METHODOLOGY, COMMUNICATION EQUIPMENT Quarterly Report, 1 May–31 Jul. 1968
William R. Free, Bernard M. Jenkins, and Charles W. Stuckey Dec. 1968 37 p refs
(Contract DAAB07-68-C-0189)
(AD-680241; GIT-A-1075-2; ECOM-0189-2; QR-2) Avail: CFSTI CSCL 17/2.1

Theoretical and experimental investigations directed toward the development of improved test techniques and procedures for performing radiated measurements in shielded enclosures continued during this reporting period. A theory to explain the presence of coupling nulls in shielded enclosures at low frequencies (below 100 MHz) was developed during the previous quarter. A series of measurements was performed during this reporting period to validate this theory. The results from these measurements demonstrate that the coupling nulls observed in the shielded enclosure in the vicinity of 40 MHz are not the result of multi-path reflections from the enclosure walls. In addition, the measurement results are consistent with the previously developed near-field coupling theory. An experimental program to develop short hooded antennas which yield constant beamwidth patterns over an appreciable frequency range was continued during this reporting period. Results obtained with two experimental short hooded antennas designed to cover the 1 to 12 GHz frequency range are presented and discussed. Author (TAB)

N69-24334*# Avco Corp., New York.
SIGNAL MUTIPLEXER
Robert C. Kinsel, inventor (to NASA) Issued 18 Feb. 1969 (Filed 9 Feb. 1966) 5 p Cl. 333–8
(NASA-Case-XGS-1110; US-Patent-3,428,919; US-Patent-Appl-SN-526684) Avail: US Patent Office CSCL 09E

A passive device is described for coupling a signal into a plurality of similar outputs wherein each output will have the same impedance as the input. The impedance is adjustable, and the input loop comprises a series connected circuit including the primary of a first transformer, the primary of a second transformer, and the secondary of the first transformer. Official Gazette of the U.S. Patent Office

N69-24379# Michigan State Univ., East Lansing. Div. of Engineering Research.
IMPEDANCE-LOADED RECEIVING ANTENNAS WITH MINIMUM BACKSCATTERING AND MAXIMUM RECEIVED POWER
Howard J. Deck and K. M. Chen Sep. 1968 130 p refs
(Contract AF 19(628)-5732)
(AD-680414; Rept-6; AFCRL-68-0583) Avail: CFSTI CSCL 9/5

A study was made of the feasibility of constructing a receiving antenna with a minimum backscattering and a maximized received power, utilizing techniques of impedance loading. With the freedom of choosing two identical loading impedances and a center load impedance, an optimum receiving antenna with zero backscattering and infinite received power can be constructed. If the degrees of freedom in choosing the loading and the center load impedances are reduced, a near optimum receiving antenna with a minimum backscattering and a maximum received power can be realized. One interesting phenomenon of frequency-rejection characteristics was observed in a reactively loaded receiving antenna which gives zero backscattering and at the same time delivers zero power to the center load. Author (TAB)

N69-24381# Michigan State Univ., East Lansing. Div. of Engineering Research.
EXPERIMENTAL INVESTIGATION OF THE MODIFICATION OF THE BACKSCATTERING CROSS SECTION OF METALLIC OBJECTS
Mervin C. Vincent and K. M. Chen Jan. 1968 130 p refs
(Contract AF 19(628)-5732)
(AD-680412; SR-5; AFCRL-68-0545) Avail: CFSTI CSCL 17/9

An experimental investigation on the backscattering cross sections of the metallic objects of various shapes is presented. The metallic scatterers are assumed to be illuminated by a plane electromagnetic wave at normal incidence. The modification of the backscattered fields of these targets is accomplished by employing the impedance loading method or the compensation method. The impedance loading method is to add some impedances on the object surface and the compensation method consists of attaching some impedance loaded wires to the target object. The backscattering cross section of a sphere is modified by the addition of two vertical cylinders loaded with appropriate impedances. Both theory and experiment yield results which are in good agreement. The backscattering cross sections of loops, either circular or rectangular, are modified by loading the loop with a pair of impedances positioned symmetrically on opposite sides of the loop. The backscattering of a plate is modified by placing an impedance loaded loop in front of the plate. Similarly, the scattered field of a thick cylinder is modified by placing a thin loaded cylinder adjacent to it. In all these schemes, a coaxial line (or cavity) has been used as the loading impedance in the experiment. Author (TAB)

N69-24382# Mitre Corp., Bedford, Mass.
THE DOPPLER MAP OF AN EDGE
M. R. Weiss Nov. 1968 21 p refs
(Contract AF 19(628)-5165)
(AD-680378; WP-2214; ESD-TR-68-276) Avail: CFSTI CSCL 17/9

Previous work on the use of narrowband interferometry for doppler processing has modeled the target as a collection of scattering centers fixed with respect to a center of mass. The present paper is intended to suggest a model for a curved edge taking into consideration the slippery nature of the scattering center.
Author (TAB)

N69-24403# IBM Italia, Milano.
COMPUTER CONTROLLED COMMUNICATION NETWORK FOR TACTICAL SYSTEMS
F. Di Trapani and R. Roselli *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 3 p (See N69-24401 12-08)
Avail: CFSTI

Operational considerations and requirements, digital computer functions, and interface and standardization problems are analyzed as related to the automation of military tactical systems. Particular emphasis is placed on problems of the connection and integration of many subsystems into a reliable and flexible network. Routing selection and error control are discussed as functions which can be performed by digital computers located in the switching centers. Once the configuration is established, a major difficulty, caused by data transmission between different automated subsystems, is encountered in system implementation. It is concluded that this can be solved by either standardizing the hardward and software interface between the subsystems and switching centers, or by assigning a part of the standardization task to the switching centers.
A.C.R.

N69-24405# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
PHILOSOPHY AND STRUCTURE OF A MULTIRADAR TRACKING SYSTEM
H. v. Issendorff and W. Pandikow *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 (See N69-24401 12-08)
Avail: CFSTI

The additional capabilities resulting from computer-aided airspace surveillance, and the requirements for implementation of a system to provide fast and precise responses to any tactical situation are briefly discussed. The tracking logic for the system is based on combination of information from several radars having overlapping ranges, to give improved performance in several key areas. The structure of such a multiradar system, where each instrument is connected to a single computer which is in turn linked to a central computer facility, is treated in detail, and it is reported that the multiradar program is operable and in the testing phase using simulated radar plots.
A.C.R.

N69-24406# Ministry of Defence, London (England).
A LIMITED AREA RADAR AUTO TRACKING SYSTEM
L. Moore *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 2 p (See N69-24401 12-08)
Avail: CFSTI

As related to the need for an inexpensive automatic tracking system for radar data, a configuration utilizing digital techniques where possible, in combination with a general purpose computer to provide maximum experimental freedom, is described. The auto extraction technique is designed to limit the input of radar data to that relevant to existing tracks, to minimize the task of target paint recognition, and to eliminate the need to associate paints with their corresponding tracks. These aims are achieved by manually initiating all tracks and subsequently limiting data extraction to small areas, called windows, which surround the expected position of the next paint for each track. It is emphasized that the success of this extraction method depends critically upon the system's ability to confine the window content to the required paint or, if that is not possible, to appreciate that unwanted video is present and to take any necessary remedial action. A brief functional description of the system is then given, with emphasis upon the manual control functions.
A.C.R.

N69-24408# IBM Italia, Milano.
AUTOMATIC INITIATION OF RADAR TRACKS IN TACTICAL SYSTEMS
P. Regi *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 2 p (See N69-24401 12-08)
Avail: CFSTI

Key problems arising in the design, engineering, and implementation of the automatic initiation function are discussed, as related to the process of radar track initiation when a new, previously unsensed target exists within a given surveillance area. It is emphasized that the increase in number of targets to be controlled and the need for high level of security and quality dictate the use of automation at all operational levels, and the performance of such an automatic process is summarized. The program to implement the basic operational requirements necessitated simulation and experimental tests to provide an accurate means of measuring performance, optimizing functional procedures, and determining the most convenient parameters.
A.C.R.

N69-24409# Societe d'Etudes des Systemes d'Automation, Paris (France).
AUTO-ADAPTIVE SMOOTHING ON INFORMATION PROVIDED BY RADAR TRACKING [LISSAGE AUTO-ADAPTATIF SUR LES INFORMATIONS FOURNIES PAR UN RADAR DE POURSUITE]
J. de Barbeyrac *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 1 p (See N69-24401 12-08)
Avail: CFSTI

Systematic errors in radar tracking signals are subjected to a smoothing technique using Taylor series expansion. To minimize the noise error it was decided that the length of the smoothing interval must be decreased and the degree of the error eliminating polynomial must be increased. Signal filtering techniques are generally applied.
Transl. by B.P.

N69-24410# Selenia S. p. A., Rome (Italy).
ANALYSIS OF AN ACCUMULATOR DETECTOR
Fulvio Marcoz *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 1 p (See N69-24401 12-08)
Avail: CFSTI

The use of the accumulator detector in quantized video detection systems, as opposed to the moving window detector, is discussed and its logic described. Topics include the behavior of the instrument in the noise situation; detection probability; and data processing techniques for obtaining the angular position of the target.
A.C.R.

N69-24411# Compagnie Generale de Telegraphie sans Fil, Paris (France).
MOVING TARGET INDICATOR CODE PHASE [MTI A CODAGE DE PHASE]
R. Carre *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 4 p In FRENCH (See N69-24401 12-08)
Avail: CFSTI

A new device is proposed which is based on the measurement of the phase of received signals; it uses digital techniques and integrated circuits. It can detect proper and contrasted panoramic images; false alarms are reduced in the zones contaminated by clutter; the detection of the target is not degraded in clear zones. The received signals are transposed to frequency signals and then transmitted to two separate channels. One of the channels measures the phase of the signal and the second, the amplitude.
Transl. by B.P.

N69-24412# Rome Air Development Center, Griffiss AFB, N.Y.
TRANSMISSION TECHNIQUE PERFORMANCE AND CHANNEL PARAMETER RELATIONSHIPS IN DATA COMMUNICATIONS
Robert C. Waag *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 2 p (See N69-24401 12-08)
Avail: CFSTI

A brief survey of selected modem technique performance from both theoretical and experimental viewpoints is presented, and annotations are made for comparative evaluation of various types of equipment. The basic communication system under consideration consisted of a data source, modulator, communication channel, and data sink. It was concluded that data collecting and handling procedures for evaluating equipment performance require a large measure of automation to insure accuracy.
A.C.R.

N69-24413# AEG-Telefunken, Hamburg (West Germany).
SOME ASPECTS OF SWITCHING CENTERS IN NETWORKS FOR INTEGRATED MESSAGE AND DATA HANDLING
G. E. Willibald *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 1 p (See N69-24401 12-08)
Avail: CFSTI

The traffic (volume, holding time, priorities, and point of termination) offered to the network by the different users determine the size of the interconnecting links, the structure of the network, and levels of switching. To achieve uniform handling of voice, record, and data messages the concept of the standard channel is introduced to facilitate rapid transfer through the network. For message switching and processing at the switching centers standard signalling and addressing procedures are advantageous. The combination of direct switching and store and forward operation complement each other in particular to achieve traffic concentration, message preparation and traffic peak equalization which in turn result in a high network efficiency and good grade of service.
Author

N69-24414# Signals Research and Development Establishment, Christchurch (England).
A COMPUTER CONTROLLED TELEGRAPH MESSAGE SWITCHING SYSTEM FOR USE IN A TACTICAL HEADQUARTERS
J. A. Clark and R. Little (Elliott Bros., Ltd.) *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 8 p (See N69-24401 12-08)
Avail: CFSTI

The design and construction are described of an experimental computer controlled telegraph message switching system for tactical use. The term message switching implies the routing of a message at a switching center by using information contained in the heading of the message itself. The equipment does this by the store and forward method in which the incoming message is stored and then retransmitted on a route deduced from analysis of the message heading. The estimated user requirements for this equipment are listed.
Author

N69-24415# Rome Air Development Center, Griffiss AFB, N.Y.
IMPROVEMENTS IN COMMUNICATIONS, NAVIGATION AND IDENTIFICATION (CNI) BY INTEGRATION
Irving J. Gabelman *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 2 p (See N69-24401 12-08)
Avail: CFSTI

A unified systems approach to communication, navigation, and identification (CNI) is described. A possible integration might be effected by the use of a single wide band transceiver which employs a common unified digital modulation technique, and which is capable of transmitting and receiving the required CNI information needs of the military aircraft. This basic black box, with some differences in physical configuration but employing the identical waveforms, would be used in ground, air, and satellite terminals. The state of the art is such that a bandwidth of the order of 100 MHz is possible. The magnitude of the bandwidth, navigational accuracy considerations, antenna factors, and propagation effects constrain the operating system frequency to the 1 to 10 MHz region. Frequencies in this band are line-of-sight limited in range and hence the system employs relay satellites to obtain extended, beyond the horizon coverage, for communications and navigational data. Information transfers between terminals within line-of-sight of each other is via the direct mode while those relayed through a satellite are via the remote mode.
B.P.

N69-24422# Service Technique des Telecommunications de l'Air, Paris (France).
DATA PRESENTATION SYSTEM OF VISU 4 [LE SYSTEME DE PRESENTATION DES DONNEES VISU 4]
G. La Rosa *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 10 p In FRENCH (See N69-24401 12-08)
Avail: CFSTI

VISU 4 is a system of visualization which can be integrated into all data handling systems and has particular tactical applications. With a modular concept and with the benefits of recent technological progress, VISU 4 offers usage possibilities quite superior to older classical display systems. After a structural description, the different elements comprising VISU 4 are discussed: the work station; the images being presented there, including their composition, selection, and topographic modification; the technical organs for image elaboration; and the element which assures a liaison between the principal computer and the data handling system.
Transl. by P.A.B.

N69-24424# Allied Naval Forces Southern Europe (Malta).
AN OFFSET TARGET INDICATOR SYSTEM (OTIS) DERIVED FROM ANIMATED RADAR SURVEILLANCE
I. H. F. Martin and B. D. Parker (Decca Navigator Co., Ltd.) *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 1 p (See N69-24401 12-08)
Avail: CFSTI

The difficulty of identifying and tracking enemy warships in the crowded shipping lanes in which they may attempt to conceal themselves is considered. Although patrol warships are more irrational in behavior than merchantmen, the difference is not apparent on radar plan position indicators (PPI) until movements have been artificially accelerated. An animator-recorder to record PPI pictures and a memory unit providing aid to the radar operator in keeping track of suspicious contacts may be used. The tactical plot officer scrutinizes the contacts passed to him by the radar operator and transmits the filtered picture through a data link to the ground station. The OTIS system is comprised of the data link, which is a variable bit rate digital communications system; an alphanumeric keyboard which allows a limited amount of information to be transmitted, and rolling balls to control electronic marker rings on the PPI and tactical plot. The simplicity of data transmission and the capability of fitting the receiving equipment into any ship or shore establishment are mentioned.
P.A.B.

N69-24470# Perkin-Elmer Corp., Norwalk, Conn. Optical Group.
OPTICAL PROCESSING OF ACOUSTIC SIGNALS Final Report, Jun. 1967–Dec. 1968
Stanley J. Kishner Dec. 1968 70 p refs
(Contract N00014-67-C-0249)
(AD-680024; ER-9493) Avail: CFSTI CSCL 20/1

The application of optical signal processing techniques to the transient detection and classification problem has been studied, and a suboptimum correlation detector that utilizes such techniques has been analyzed. The transient problem is first defined, and Noltes optimum adaptive detector is described. A suboptimum correlation detector is compared to the optimum adaptive detector, and a description of the optical realization of the correlation detector is given. The results indicate that this detector performs well in comparison to the optimum detector for synchronously recurrent transients under low signal-to-noise conditions, and is optimum for periodic transients. For the sporadic transient case, it is concluded that the implementation of nonlinear signal processing in optical systems should be investigated. Author (TAB)

N69-24515# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMUM DISCRETIZATION (ENCODING) OF MEASURING SIGNALS
V. A. Vittikh and A. N. Ginzburg May 1968 15 p refs Transl. into ENGLISH from Avtometriya (USSR), no. 3, 1965 p 26–33
(AD-682800; FTD-HT-23-82-68) Avail: CFSTI CSCL 9/6

Optimal encoding of fully known continuous signals, considered as determined functions of time, is discussed mathematically. The problem reduces itself to the minimization of some error functional, or to determining the minimal value of epsilon-entropy by successive approximation. Dynamic programming is deemed preferable to standard methods of classic analysis, even though it requires the employment of a universal digital computer. Author (TAB)

N69-24530# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LIGHT RAYS THAT CARRY INFORMATION
Ya. Eidus May 1968 14 p Transl. into ENGLISH from Nauka i Tekan. (Moscow), no. 11, 1966 p 5–9
(AD-680574; FTD-HT-23-1544-67) Avail: CFSTI CSCL 17/2

The ever-expanding need for exchange of information has crowded the radio frequency spectrum. A qualitatively new solution to the problem of channel capacity is offered by the recently created sources of monochromatic coherent light. These so-called masers and lasers operate at extremely high frequencies, and, since the quantity of information theoretically able to be transmitted on a communications channel is directly proportional to the frequency, their theoretical information capacity is tremendous. The capacity of a laser communications channel is at least 1000 times greater than the capacity of all radio channels used up to now, including microwave. The primary problem hindering laser communications now is modulation of the laser beam. Theoretically, any of the four standard parameters of a laser beam can be modulated to place information of the beam: frequency, amplitude, phase and polarization. Actually, two primary methods can be used to modulate the light beam exiting from a laser: internal and external methods. In the first case, the light beam is acted upon as it is being formed, i.e., within the actual laser. In the second case, the modulation is performed after the beam has been created. Internal methods include regeneration modulation, modulation using the Stark effect and modulation using the Seeman effect. Scientists at present are giving preference to the external modulation methods, which include modulation of the pumping, mechanical modulation, modulation using the Faraday effect, modulation using the Kerr effect and modulation using the optical birefringence effect in piezoelectric crystals. TAB

N69-24535# Mitre Corp., Bedford, Mass. Communications Techniques Dept.
PERFORMANCE OF TWO-DIMENSIONAL ERROR DETECTION ON DIGITAL HF AND TROPOSCATTER CHANNELS
Kenneth Brayer Dec. 1968 20 p refs
(Contract AF 19(628)-5165)
(AD-680382; MTP-65; ESD-TR-68-430) Avail: CFSTI CSCL 17/2

The problem of applying horizontal and/or vertical parity checks for error detection to actual burst channels is considered. It is demonstrated that a single-dimension parity check will achieve two to four orders-of-magnitude improvement, and, within the limit of the data sample, both dimensions together detect all errors. It is proved that the parity check at the intersection of the horizontal and vertical checks can be calculated from either set of checks and that errors can be detected in the information independent of those in the non-intersecting checks. Author (TAB)

N69-24539# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF SPEECH RECOGNITION CRITERIA
E. T. Semenova Apr. 1968 9 p Transl. into ENGLISH from Nauchn. Sov. po Kompleksono Probl. Kibernetika. Bionika (Moscow), 1965 p 51–54
(AD-680571; FTD-HT-23-1-68) Avail: CFSTI CSCL 17/2

A method and apparatus is proposed for analyzing the criteria for speech recognition. The first part of the work consists of studying the Russian vowel sounds (a), (o), (i), (u), and (e). Oscillograms were made for each of these sounds. The spectrum of each sound was examined. The spectral analysis of the vowels was carried out on the ASChKh-1 spectral analyzer. The controlled analysis of the frequency spectrum was carried out on the Ural-1 computer. On the basis of a preliminary analysis of the oscillograms, an apparatus was set up for discerning vowel sounds recorded by one informant. The same procedure was followed for the consonants. These were divided into three groups: nasals, fricatives, and occlusives. Seven informants took part in this study, four men and three women. Preliminary analysis of the oscillograms showed the feasibility of studying the amplitude-frequency-time characteristics of these sounds. An apparatus was set up for conducting the above study. The sound under study is recorded on a tape, amplified, and passed through a system of filters with variable frequency tuning. It is then demodulated and quantized according to levels. The equipment used in this experiment is not objective in recognizing sounds. It is useful only for recognizing the sounds of a single speaker. Author (TAB)

N69-24568# Boeing Scientific Research Labs., Seattle, Wash.
POWER RADIATED BY OSCILLATING MAGNETIC AND OSCILLATING ELECTRIC DIPOLES IN A COLD, STREAMING PLASMA
John E. Bergeson Nov. 1968 29 p refs
(AD-680353; DI-82-0793) Avail: CFSTI

The power radiated by oscillating magnetic and oscillating electric point dipoles is calculated for the case where the dipoles are immersed in a cold, streaming plasma. The power output of the dipoles in a streaming plasma is less than it is in a stationary plasma, although the correction term is of order beta squared, where beta is the ratio of the plasmas streaming velocity to the velocity of light. The power output is calculated by a generalized Poynting vector method, using electromagnetic field expressions derived from a set of linearized, covariant cold plasma equations. The results of this paper are compared with the results of Daly, Lee and Papas and of McKenzie who calculate the power output of the oscillating electric dipole from a dispersive medium point of view. Author (TAB)

N69-24573# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Electrophysics.
AN EXPERIMENTAL STUDY OF RADIO WAVE PROPAGATION IN SIMULATED FORESTS AND OTHER DISSIPATIVE ENVIRONMENTS Semiannual Report, 15 Feb.–15 Aug. 1968
Theodor Tamir Sep. 1968 12 p refs
(Contract DAABUT-68-C-0222; ARPA Order-371)
(AD-680308; PIBEP-68-0181; ECOM-0222-1; Rept-1) Avail: CFSTI CSCL 17/2.1

The general features of the set-up that is intended to serve as the laboratory model are discussed and the considerations concerning the frequency of operation, the basic measurements to be undertaken and the appropriate characteristic parameters are described. The dielectric material that would simulate a vegetative medium was the subject of extensive experimentation which represents the major effort during the past interval. Satisfactory dielectric media were produced by doping a foaming material with carbon powder or with absorbent fibers. Their properties and electrical characteristics were measured and are reported herein. Author (TAB)

N69-24618# Services Electronics Research Lab., Baldock (England).
A HIGH-POWER CW RING-BAR TRAVELLING-WAVE TUBE
M. O. Bryant and F. E. Wray *In its* SERL Tech. J., Vol. 19, No. 1 Feb. 1969 7 p refs Presented at the 7th Intern. Conf. on Microwave and Opt. Generation Amplification, Hamburg, Sep. 1968 (See N69-24617 12-34)
Avail: CFSTI

A ring-bar travelling wave tube was developed which gives a CW output power greater than 7 kW in the 6 GHz band, with a large-signal gain exceeding 30 dB and a power bandwidth to 1 dB points of 12%. The slow wave structure is machined from high conductivity copper tube and brazed to beryllia posts which provide good thermal connection to a heat sink. Particular care was taken in the design to combine good mechanical reproducibility with ease of construction. The tube has an electromagnet which gives excellent beam transmission for low power consumption and is easy to handle. Author

N69-24619# Services Electronics Research Lab., Baldock (England).
A BROAD-BAND WAVEGUIDE WINDOW FOR HIGH-POWER MICROWAVE TUBES
P. H. Cross *In its* SERL Tech. J., Vol. 19, No. 1 Feb. 1969 9 p ref Presented at 7th Intern. Conf. on Microwave and Opt. Generation Amplification, Hamburg, Sept. 1968 (See N69-24617 12-34)
Avail: CFSTI

A C-band vacuum window suitable for the average power transmission of up to at least 10 kW, and with a bandwidth of more than 40% is described. Designed primarily as a CW window, it features a relatively small dielectric element in the form of a biconcave disk which exhibits a number of advantages. Author

N69-24637# Mitre Corp., Bedford, Mass.
BACKGROUND FOR NARROWBAND INTERFEROMETRY, PART 1: ISOTROPIC POINT SCATTERERS
H. S. Ostrowsky Nov. 1968 29 p ref
(Contract AF 19(628)-5165)
(AD-680380; WP-2015; ESD-TR-68-275) Avail: CFSTI CSCL 20/14

A recent paper described a method for using narrowband interferometry at small bistatic angles to obtain two and three dimensional images of targets in terms of their scattering centers. The present paper is intended primarily to provide additional background information and a theoretical foundation for such narrowband interferometry and to consider some of its limitations, and secondly to indicate what information is to be found in the data and how it might be used. Author (TAB)

N69-24670# System Development Corp., Santa Monica, Calif.
ON THE NON-EXISTENCE OF PERFECT DOUBLE HAMMING-ERROR-CORRECTING CODES ON Q = 8 and Q = 9 SYMBOLS
Ronald Alter Nov. 1968 19 p refs
(AD-680112; SDC-SP-3195/000/02) Avail: CFSTI CSCL 9/4

This work is a continuation of an earlier paper by the author where a similar result is achieved for the value q = 7. By generalizing and extending the techniques developed in this earlier paper the diophantine equations y squared = 8 to the (k+1) power + 17 and y squared = 2 x (9 to the kth power) + 7 are shown to have no solution in integers for k > 2. Since this is a necessary condition for the existence of perfect double Hamming-error-correcting codes on q = 8 and 9 symbols respectively, it follows that there exist no such codes. Author (TAB)

N69-24691# Arcon Corp., Wakefield, Mass.
REENTRY TRACKING MODELS IN RADAR POLAR COORDINATES AND STATISTICAL TESTING PROCEDURES FOR MODEL SIMPLIFICATION
Oct. 1968 59 p refs Prepared for Lincoln Lab., MIT
(Contract AF 19(628)-5167; ARPA Order-498)
(AD-680387; R68-3W; ESD-TR-68-349) Avail: CFSTI CSCL 17/9

The report describes (a) an outline of the Kalman-based tracking procedure for reentry trajectories, (b) a detailed derivation of a mathematical model to implement this procedure in radar polar coordinates, and (c) methods for checking, via simulation, the degree of degradation introduced by model simplifications and other changes. Author (TAB)

N69-24698# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MULTIPATH SUPPRESSION BY SWEPT FREQUENCY METHODS
Richard A. McGee Nov. 1968 29 p refs
(AD-682728; BRL-MR-1950) Avail: CFSTI CSCL 17/9

The suppression of multipath propagation effects by random and sinusoidal frequency modulation is investigated theoretically. Experiments using a 94 GHz noise radar show the theoretical results to be correct. Suppression of multipath effects using Gaussian noise modulation exhibits an exponential behavior as a function of the product of the RMS frequency deviation (Delta omega) and the multipath delay time (Upsilon). Sinusoidal modulation results in multipath suppression which behaves as the absolute value of the zero order Bessel function of the first kind whose argument is (Delta omega Upsilon). Author (TAB)

N69-24709# Ohio Univ., Athens.
RADIO THEODOLITE PLACEMENT CRITERIA FOR GLIDE PATH MEASUREMENT Final Report
Richard H. McFarland Jan. 1969 13 p Supported by FAA
(AD-682892; RD-69-4) Avail: CFSTI CSCL 17/7

Some Category II ILS facilities appear to possess paths which exceed the allowable tolerances as defined in FAA order 8200.11A. The intent of the consulting study was to investigate ways for altering the subject paths to within tolerance conditions. Atlanta 09R was selected as the facility for consideration and field demonstration. During the course of investigation, theoretical

evidence came to light which questioned the existing theodolites placement, as defined in the subject order, to be used as the standard placement. The project effort concluded in an exact definition of a standard facility, a redefinition of the theodolites standard placement and the Atlanta OSR glide paths re-evaluation.
Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N69-23381*# Lockheed Missiles and Space Co., Palo Alto, Calif.
REMOTE INFORMATION RETRIEVAL FACILITY
Roger K. Summit Washington NASA Apr. 1969 48 p
(Contract NASw-1454)
(NASA-CR-1318; N-07-68-1) Avail: CFSTI CSCL 09B

A summary of work performed is given, including the installation of a remote terminal base at Ames Research Center, California, for the use of engineers and scientists in conducting on-line searches on the NASA collection of machine-readable document citations, and the later relocation of the terminal at NASA headquarters in Washington, D. C. The file conversion process is described, along with the system operation at each terminal. The DIALOG information retrieval language used and the computer environment within which the set of programs operates are discussed, with details on command language modifications and on the major hardware components of the IBM 360/30. A comparative analysis of system utilization during the two separate operational phases is presented, with reference to search characteristics and user reaction. Individual search summaries from the first phase are included.
P.A.B.

N69-23444*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
ANALYSIS AND SYNTHESIS OF DISTRIBUTED LUMPED ACTIVE NETWORKS BY DIGITAL COMPUTER Semiannual Report, 1 Sep. 1968–28 Feb. 1969
L. P. Huelsman 28 Feb. 1969 8 p refs
(Grant NGL-03-002-136)
(NASA-CR-100699) Avail: CFSTI CSCL 09B

This research project is concerned with an investigation of the ways in which a modern digital computational facility may be used in the analysis and synthesis of networks whose elements are distributed, lumped, and active. Such networks may be referred to as DLA (distributed lumped active) networks. During this six-month period, the major emphasis of the research investigation was in three major areas: (1) the use of optimization techniques to provide a vehicle for the synthesis of DLA networks; (2) the examination of some additional mathematical processes suitable for the modeling of distributed elements, with a view to correlating the accuracy and computation time of these processes with ones which have already been examined; and (3) the extension of existing analysis capabilities for the DLA network so as to encompass an even broader range of possible network elements.
Author

N69-23506# Rochester Univ., N. Y. Nuclear Structure Research Lab.
A SPARK COUNTER DATA ACQUISITION SYSTEM USED WITH A MAGNETIC SPECTROGRAPH
H. W. Fulbright and J. A. Robbins Feb. 1969 44 p refs
Sponsored by NSF
(Contract AT(30-1)-875)
(UR-NSRL-9) Avail: CFSTI

A data acquisition system based on the use of a sonic spark counter at the focal position of a magnetic spectrograph is described. The output of the spark counter is fed into a computer which processes the events on-line, presents a cathode ray display for continuous monitoring during experiments, controls the recording of the reduced data on magnetic tape, and, by use of an incremental recorder, on paper, in graphical form. Separate spectra are obtained, automatically separated, for protons, deuterons, hydrogen 3, helium 3, and helium 4. The resolution is better than 1 mm. Counting rates up to 100 per second have been used. The system has been employed successfully in a number of experiments over a period of about two years.
Author

N69-23530*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPUTER PROGRAM FOR ELECTRON PROBE MICROANALYSIS IN THE FIELDS OF METALLURGY AND GEOLOGY
J. I. Goldstein and P. A. Comella Apr. 1969 85 p refs
Submitted for publication
(NASA-TM-X-63518; X-642-69-115) Avail: CFSTI CSCL 09B

A comprehensive computer program has been written which should prove useful to investigators in both the fields of metallurgy and geology. The program is written in the Fortran language and can be used in remote terminal operation. The program operates in either of two modes: conversion of raw intensity data to composition using an iterative procedure, or conversion of compositional data to expected x-ray intensities. The program is rather unique with respect to the method of data handling and ease of operation. All the critical data for a given element, such as x-ray wave lengths, fluorescence yields, atomic weights, absorption edge jump ratios and the necessary factors for the calculation of mass absorption coefficients are stored on cards or are placed on file at the computer. These data are then used as needed for the elements under consideration in each problem. The compositional data for each of the element standards are also stored on cards or at the computer. The input data which specifies the problem of interest then requires a minimum of information and can be supplied in a non-rigid format.
Author

N69-23540*# Physics International Co., San Leandro, Calif.
THE MONK CODE: USER'S MANUAL Final Report
15 Feb. 1969 39 p (Contract NAS9-8030)
(NASA-CR-99617; PIFR-119) Avail: CFSTI CSCL 09D

The MONK is a code for generating equation of state data. The input consists of: (1) required input parameters; (2) required input tables; (3) optional input data sets that may include parameters such as melting point, boiling point, a known sublimation point V_{SUBL}, T_{SUBL} and others; and (4) listed inputs E, V for which P and T will be computed for output. This last input feature accounts for more than half of the code complexity than would have been present had E and T been chosen for input. The E, V input choice has the virtue that the code can be adapted to a mode that outputs Hugoniot point corresponding to a V input list, and constructs release adiabats from each Hugoniot point.
Author

N69-23554# National Aeronautical Establishment, Ottawa (Ontario).
AUTOMATIC SEPARATION OF STRAIN AND PARTICLE SIZE EFFECTS IN EXPERIMENTALLY OBSERVED X-RAY LINE SHAPES
W. Wallace Dec. 1968 15 p refs
(NRC-10641; NAE-ME-120) Avail: CFSTI

A computer method is described that provides a complete analysis of experimentally observed X-ray line shapes, producing

estimates of lattice strain and particle size in a single operation. It is shown that the method produces results comparable with those obtained from the conventional two-state analysis. Author

N69-23587*# Auburn Research Foundation, Inc., Ala.
DIGITAL COMPENSATION OF THE THRUST VECTOR CONTROL SYSTEM Technical Report, 1 Oct. 1967–31 Jan. 1968
C. L. Phillips 31 Jan. 1968 42 p refs
(Contract NAS8-11274)
(NASA-CR-100704; TR-10) Avail: CFSTI CSCL 09B

Analysis techniques are developed for a sampled-data control system using a multirate controller. The simulation of a continuous time system containing a digital controller is accomplished through the use of discrete-time techniques. Author

N69-23575# General Electric Co., Schenectady, N. Y.
SUPRFOX: A PROGRAM AND SUBROUTINES FOR PROCESSING X-RAY PHOTOMETER DATA AND DATA SIMILARLY ARRAYED INTO ROWS AND COLUMNS
A. S. Covert 10 May 1968 31 p
(Contract W31-109-eng-52)
(KAPL-M-6921) Avail: CFSTI

A guide is provided for using SUPRFOX, a FORTRAN 4 program for processing x-ray photometer data. The purpose of the program is to develop measures of process capability. Input and output are described. The output, which is printed and graphic, contains descriptive statistics and analyses of variance. Examples of the quantitative interpretation of the analysis of variance are given. Author (NSA)

N69-23595*# Auburn Univ., Ala. Engineering Experiment Station.
SIMULATION OF HIGH-ORDER HYBRID CONTROL SYSTEMS
C. L. Phillips Jul. 1968 72 p refs
(Contract NAS8-11274)
(NASA-CR-100668; TR-12) Avail: CFSTI CSCL 09B

The attitude control system of the Saturn V booster stage was used throughout to illustrate the applicability of these simulation methods. The first simulation procedure uses only analog components with the exception of two sample-and-hold elements. The second method uses both analog and digital devices. The analog computer is used to stimulate the continuous-time portion of the system and the digital portion of the system is simulated by a special purpose digital device. Finally, the system is simulated wholly on a digital computer using discrete-time techniques. Each of the three techniques discussed above is shown to result in the development of an accurate simulation for the system model under consideration. Author

N69-23683*# Auburn Univ., Ala. Engineering Experiment Station.
THE DESIGN AND IMPLEMENTATION OF A LABORATORY-ORIENTED GENERALIZED VARIABLE-ORDER DIGITAL COMPENSATOR
C. C. Carroll May 1968 83 p refs
(Contract NAS8-11274)
(NASA-CR-100667; TR-11) Avail: CFSTI CSCL 09B

The design permits future construction to be facilitated almost completely through the use of integrated circuitry. The versatility of the compensator is demonstrated in two ways: (1) the compensation function can be altered to give 2nd, 4th, or 6th order operation by making minor external adjustments to the machine and (2) for a given order, the coefficients of the transfer function can be set to a wide range of values, thereby providing the capability of an even greater variety of realizable functions. The resolution of the coefficients was made high enough to eliminate coefficient quantization as a problem source. The compensator, as a special purpose computer, will be utilized in the hybrid simulation of the Saturn V thrust vector control system, although the computer may be adapted to many diverse sampled-data systems. Author

N69-23705 Syracuse Univ., N. Y.
A LINGUISTIC APPROACH TO MECHANICAL PATTERN RECOGNITION
Peter John Knoke (Ph.D. Thesis) 1968 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-13840

Brief discussions of the pattern recognition problem, motivation, and categories for pattern recognition work are followed by a detailed discussion of a linguistic approach to pattern recognition. The reasoning is that since the mechanical pattern recognition problem is similar to the problem of mechanical language translation, the theory and techniques applicable to the latter may also be applicable to the former. A linguistic approach to pattern recognition involves an attempt to apply theory and techniques of mathematical linguistics. Two sample applications are discussed. The first of these, concerning the mechanical recognition of machine-produced or hand-printed characters, is covered formally and in detail. A computer program based on a linguistic approach is described, and results of test of this program are given. The second application, concerning mechanical analysis of clinical electrocardiograms, is treated more briefly. Dissert. Abstr.

N69-23763# Gulf General Atomic, San Diego, Calif.
TOAD: A COMPUTER CODE FOR PROCESSING GAMMA-RAY SPECTRA
J. Drake, L. L. Stewart, and D. D. Busch 3 Apr. 1968 85 p refs
(Contract AT(04-3)-167)
(GAMD-8266) Avail: CFSTI

TOAD is designed for use with the UNIVAC 1108 (64K) computer and is used primarily for processing data from the Gulf General Atomic 4096-channel TMC analyzer with magnetic tape readout. A description of subroutines, explanation of input variables, changes for processing certain binary tapes, computer and tape requirements, input forms, source program, and a sample problem are presented. NSA

N69-23771# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
DISBLR: A TRACE AND DISASSEMBLER PROGRAM FOR THE IBM SYSTEM/360
N. K. MacLaurin Dec. 1968 8 p refs
(AAEC/TM490) Avail: CFSTI

The DISBLR is a subroutine designed to trace programs on an IBM System 360 computer at machine language level. It does this by simulating the effect of the IBM System 360 hardware on successive machine instructions. A trace of SVC interrupts is possible if desired. The output from DISBLR can be either stored in core storage and sorted on its location in core before printing, or can be printed in the order of occurrence of the instructions. The printed output from DISBLR includes a disassembly of each instruction encountered, together with its operands. Author

N69-23776 Oregon State Univ., Corvallis.
TERNARY ARITHMETIC IN DIRECT DIGITAL CONTROL SYSTEMS
David Alvin Seamans (Ph.D. Thesis) 1968 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-14488

The development of new electronic devices and design procedures applicable to ternary switching circuits suggests that it might be desirable to use ternary arithmetic in direct digital control

systems. The advantages of decimal, binary, and ternary arithmetic in digital computers are discussed and a set of rules for signed-digit ternary arithmetic is given. Some of the more useful kinds of ternary switching algebra are reviewed and several procedures for the realization of ternary switching functions are illustrated. Some ternary switching circuits using field-effect transistors are described and a new notation which appears to be convenient for describing ternary switching functions is proposed. The control system of an electric power station is discussed and the characteristics of digital and analog components in such a system compared. Dissert. Abstr.

N69-23792# California Univ., Berkeley. Lawrence Radiation Lab.
THE COBWEB DATA REDUCTION SYSTEM
Herbert C. Albrecht, Eugene P. Binnall, Robert W. Birge, Myron H. Myers, and P. Wes Weber 21 Oct. 1968 74 p refs Revised
(Contract W-7405-eng-48)
(UCRL-18528-Rev) Avail: CFSTI

Cobweb is a computer-controlled data reduction system which consists an IBM 7044 computer, a time-sharing program, two LRL-built electronic interfaces, improved automatic-tracking Franckenstein-type measuring machines, and scan tables with teletypes. The purpose of the system is to acquire data on-line in a rapid, reliable fashion from the scanning and measuring of bubble chamber film. The editing of data is done off-line on a CDC 6600 computer. The result is a large gain in measuring rate with few errors. NSA

N69-23797# Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.
CONVERSION OF GAURIBIDANUR SEISMIC ARRAY DATA INTO COMPUTER COMPATIBLE FORM
Ram Datt 1968 12 p
(BARC-357) Avail: CFSTI

The process of conversion of the analog data from a twenty element seismic array into a suitable format for CDC 3600 computers is described. The methods of conversion, storage, and signal retrieval from the digitized data are discussed, along with the problem of synchronization. The limitations and scope of the data acquisition system are mentioned. Author

N69-23811*# Stanford Research Inst., Menlo Park, Calif.
TECHNIQUES FOR THE REALIZATION OF ULTRARELIABLE SPACEBORNE COMPUTERS Interim Scientific Report
J. Goldberg, H. S. Stone, A. Waksman Dec. 1968 59 p refs
(Contract NAS12-33; SRI Proj. 5580)
(NASA-CR-86141; ISR-4) Avail: CFSTI CSCL 09B

The techniques developed are in support of computer structures in which reliability is achieved through autonomously controlled logical reconfiguration and fault masking. The report presents techniques for the accommodation of faults in data commutation networks based upon crossbar-type switching arrays. Schemes are developed for accommodating switching failures and for embedding logic for the control of alternative switching setups within the network. Several schemes are developed that are appropriate for random and for correlated fault types. The second topic is a consideration of criteria for the selection of an instruction set for a spaceborne computer. Several merits are found for the use of stack-organized instructions, together with special registers for specifying the context of a process. Possible advantages of indirect addressing are also discussed. Author

N69-23845# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
ETOM-1: A FORTRAN 4 PROGRAM TO PROCESS DATA FROM THE ENDF/B FILE TO THE MUFT FORMAT
Robert A. Dannels and Daniel E. Kusner Oak Ridge, Tenn. AEC May 1968 86 p refs
(Contract AT(30-1)-3688)
(WCAP-3688-1; ENDF-113) Avail: CFSTI

The ETOM-1 is a digital computer program which processes basic nuclear data in the ENDF/B format and produces library data for the MUFT or P1MG programs. ETOM-1 is written entirely in ASA standard FORTRAN and is designed to be computer independent. Along with printed results, the output includes punched cards in the format appropriate to the desired library. Author (NSA)

N69-23876# Argonne National Lab., Ill.
ARGONNE CODE CENTER: COMPILATION OF PROGRAM ABSTRACTS, SUPPLEMENT 1
M. K. Butler, Nancy Holister, Marianne Legan, and L. Ranzini Jan. 1968 260 p refs
(Contract W-31-109-eng-38)
(ANL-7411-Suppl-1) Avail: CFSTI

A bibliography of computer program abstracts referring to available computer programs at the Argonne Code Center is presented. NSA

N69-23984*# Brown (D.) Associates, Inc., Melbourne, Fla.
GEODETIC DATA ADJUSTMENT PROGRAM
J. J. Lynn *In* Commun. and Systems, Inc. Proc. of the GEOS Program Rev. Meeting, Vol. 3 Feb. 1968 p 53–58 (See N69-23961 12-07)
(Contract NAS5-9938)
Avail: CFSTI CSCL 09B

The Geodetic Data Adjustment Program has been developed for the reduction and analysis of GEOS satellite data; it is an error model adjustment program designed to solve a wide variety of problems belonging to the class of minimum variance statistical estimation. The problem formulation is restricted to tracking targets moving relative to some fixed coordinate frame and possibly subject to dynamic constraints imposed by the differential equations of motion due to gravitational force. This class is further restricted to those containing observations in coordinate systems commonly known as range, azimuth, elevation, topocentric right ascension, topocentric declination, direction cosines, range and range rate, azimuth, and elevation rate. Statistical information associated with the observations as well as with various other parameters entering into the description of the trajectory data may be entered into the program and processed rigorously subject to certain statistical assumptions. The fundamental assumptions are that the data observations contain random error and systematic error and that the random error has zero mean and contains no cross or serial correlation with errors on other observational data sets. Author

N69-24114# Brookhaven National Lab., Upton, N. Y. Dept. of Physics.
DATA TERMINAL NETWORK WITH ACCESS TO A LARGE COMPUTER COMPLEX
B. B. Culwick, E. Glazer, D. V. Hirst, and T. C. Meehan 24 Oct. 1968 11 p ref Presented at the Intern. Conf. on Advan. Data Process. for Bubble and Spark Chambers, Argonne, Ill., 28–30 Oct. 1968
(BNL-13045; A-207; Conf-681025-3) Avail: CFSTI

The Bubble Chamber Group at Brookhaven has constructed a system called a Data Terminal Network in collaboration with the Instrumentation and Applied Mathematics division of the laboratory. The design objective of this network is to provide members of the Bubble Chamber Group with a convenient means of access to the laboratory's central computer, a dual CDC 6600 with Extended Core Storage. In addition to access to the central computer, remote terminals are serviced to some extent by a satellite computer

which handles the scheduling of resources. Remote terminals consist of a teletype, a relatively powerful CRT display, and a track-ball which serves the pointing function on the CRT screen. Development of the system is described. Author (NSA)

N69-24145# New York Univ., N. Y. Inst. for Computer Research in the Humanities.
A COMPUTER STRING-GRAMMAR OF ENGLISH, PART 1, PART 2, AND PART 3
Naomi Sager Nov. 1968 232 p refs
(Proj. Linguistic String)
(Rept-4) Avail: Issuing Activity

The grammar is presented on a working computer program for the syntactic analysis of English sentences into their component strings. The grammar is based on linguistic string analysis and starts from the sketch of an English string grammar. Computer grammar is set down in a non-program-specific form, so that future reworkings of the grammar or reprogrammings can start from a neutral description, free of the limitations imposed by the previous representation. The string grammar is documented from the linguistic point of view. J.A.M.

N69-24350# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
BEAVER: AN INTEGRATION AND/OR DIFFERENTIATION PROGRAM
Daniel C. Poteralski 31 Jul. 1968 11 p refs Revised
(Contract W-31-109-ENG-52)
(KAPL-M-6949 (DCP-1)-Rev-1) Avail: CFSTI

The BEAVER is a short running computer program, which integrates and differentiates the general polynomial equation $A_0 + A_1X + A_2X^2 + \ldots A_nX^n$ and the expotential equation Ae^{BX}. The input format allows the user to enter the coefficients of both general equations directly from the output of CURFIT, a program which fits experimental data to analytical functions such as the general exponential and polynomial equations. The BEAVER program contains a TAB option, which can be used to generate an integral curve between the limits specified by the user. This option is very helpful in evaluating integral rod worth and temperature defect curves from measured sensitivities and temperature coefficients. Tables showing input formats, symbols, and output samples are included. Author

N69-24353# System Development Corp., Santa Monica, Calif.
ADVANCED DEVELOPMENT PROTOTYPE Semiannual Technical Summary Report, 30 Jan.–30 Jul. 1968
J. I. Schwartz Jul. 1968 57 p refs
(Contract DAHC15-67-C-0149; ARPA Order 939)
(AD-680248; SDC-TM-3828/002/00) Avail: CFSTI CSCL 9/2

A discussion is given of ADEPT -- a comprehensive information-processing system being implemented for operation on IBM 360 computers. The report includes an overview of the current status of system development, and a detailed description of the three major components of ADEPT: a time-sharing executive, a data management component (consisting mainly of the Time-Shared Data Management System), and a programmers package, which includes a JOVIAL compiler, editing, debugging, and utility programs, a teletype interpreter (TINT), and an Interactive Programming Support System. Also included in the document are the names of staff members assigned to each of the three major project areas, as well as a listing of the documents produced in each area during the reporting period. Author (TAB)

N69-24398# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHINA PRODUCES NEW MODEL LARGE-SCALE TRANSISTOR ELECTRONIC COMPUTER FOR GENERAL USE
Apr. 1968 4 p Transl. into ENGLISH from Jen Min Jih Pao (Peking), 1967 p2
(AD-680562; FTD-HT-23-199-68) Avail: CFSTI CSCL 9/2

The Institute of Computing Technology, Chinese Academy of Sciences, recently designed and successfully trial-produced a huge advanced transistorized digital computer. TAB

N69-24401# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNIQUES FOR DATA HANDLING IN TACTICAL SYSTEMS
Nov. 1968 75 p refs
(AGARD-ES-5) Avail: CFSTI

Extended summaries are presented on the conference papers pertaining to data handling techniques, use of sensors at remote locations, information transmission and processing, and reduction and sorting techniques. For individual titles, see N69-24402 through N69-24424.

N69-24404# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
FUTURE REQUIREMENTS FOR TACTICAL DATA HANDLING TECHNIQUES IN AIRCRAFT
Robert S. Aha *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 8 p (See N69-24401 12-08)
Avail: CFSTI

Data handling requirements and problems for present and near future tactical aircraft configurations of the attack, electronic countermeasures, airborne early warning radar, observation-field surveillance, and antisubmarine types are discussed. It is emphasized that such aircraft, which utilize large data handling systems, have a common problem in extracting information from the great mass of data collected by airborne tactical sensors. Following an analysis of the various types, missions, and foreseeable problems faced by future modifications of today's aircraft, the conclusion is reached that a possible approach to solving many difficulties is the establishment of an avionics panel made up of existing accredited associations along with military and industrial representatives to study, compile and define the future requirements. A.C.R.

N69-24407# Compagnie Francais Thomson-Houston, Bagneux (France).
STUDY BY REALISTIC SIMULATION OF STATUS ELABORATION IN A TERRESTRIAL BATTLEFIELD DATA PROCESSING SYSTEM [ETUDE PAR SIMULATIONS REALISTES DE L'ELABORATION DE SITUATION DANS UN SYSTEME INFORMATIQUE POUR CHAMP DE BATAILLE TERRESTRE]
L. Gerardin, C. Goix, and C. Halna *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 2 p In ENGLISH and FRENCH (See N69-24401 12-08)
Avail: CFSTI

The factors which cause extended difficulties in automatic elaboration of the general situation in a terrestrial battlefield, as opposed to air battle, are discussed, and the use of computer simulation techniques to arrive at the optimum logical process is analyzed. Two main parameters were found to characterize the qualities of a tracking logic: (1) the rate of false tracks in relation to the rate of false plots; and (2) the possibility of continuing the regular tracking of the vehicles despite the nearby false plots. Statistical estimation for the rate of false plots was obtained for the first parameter; while the second was studied by animating a large number of successive adjacent situations, printing the results by computer, and filming them according to the classic technique of cartoons. In addition, the effect of ground relief was studied and programs for simulating this factor were developed. A.C.R.

N69-24416# Royal Radar Establishment, Malvern (England).
HIGH-LEVEL LANGUAGES FOR RADAR DATA PROCESSING: A PRACTICAL APPROACH
J. G. Gibbs *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 2 p (See N69-24401 12-08)
Avail: CFSTI

Many claims are made for the usage of high level programming languages: increased speed and accuracy of program writing, ease of testing, minimal difficulty in subsequent amendment. Despite these and other claims, the use of language programming appears to have found little favor in the fields of radar data processing and air traffic control. The reasons for this apparent anomaly are discussed and an approach is proposed to the design of high level language which is matched to the practical requirements of this field of work. The state of development so far attained and the lines along which further work is proceeding, with a forecast of the results which it is hoped to achieve, are indicated.

N69-24417# Informatics, Inc., Bethesda, Md.
SIMULATING A TACTICAL IMAGE INTERPRETATION FACILITY IN THE LABORATORY
John J. Evans *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 5 p (See N69-24401 12-08)
Avail: CFSTI

A laboratory simulation of an advanced tactical image interpretation facility (TIIF) was constructed and is being tested. This computerized system was designed to provide (1) rapid retrieval of needed references, (2) specifications for optimal team communications and operating methods, and (3) procedures for controlling systems operations and interpreter decision processes. Tests of the simulation are being conducted according to prearranged plan schedules and procedures. Author

N69-24418# Litton Systems, Inc., Van Nuys, Calif. Data Systems Div.
ADVANCED SYSTEM EFFECTIVENESS TECHNIQUES
Robert Stuckelman *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 2 p (See N69-24401 12-08)
Avail: CFSTI

Advanced techniques for defining and evaluating the effectiveness of command and control systems are described. A system is modeled with flow charts, and performance is computer evaluated, based upon thousands of design parameters included in the model and using multiple input messages and various combinations of mission loading. The system's performance is predicted in terms of reaction time for the various missions. Design decision impacts are evaluated by ascertaining the effects of differing parameters on the overall composite measure of performance. Management is permitted continuously to monitor performance coincident with cost and schedule. Although the statistical prediction techniques were evolved for the TACFIRE system being developed for the U.S. Army, the method is generally applicable to other command and control systems. P.A.B.

N69-24419# Siemens A.G., Munich (West Germany).
A SMALL SIZE COMPUTER FOR RADAR DATA PROCESSING
H. Goerling and R. Stark *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 6 p (See N69-24401 12-08)
Avail: CFSTI

A computer is needed which can generate the data of genuine plots, by assembling the individual radar data of the same target and by correlating primary and secondary radar data, and then transfer this plot data to the user over a varying number of telephone lines. The requirements the computer must meet are listed, and the structures and technical layouts of the central processing and data communication units are described, along with a survey of the system operation. Input rate and data flow through the computer are considered, with individual programs performing the functions of input, secondary radar data processing, primary radar data processing, final processing, and output. Storage capacity requirements and computer time requirements for the individual programs are illustrated in diagram form. P.A.B.

N69-24420# Plessey Co., Ltd., Ilford (England).
IMPROVEMENTS IN RADAR DATA HANDLING SYSTEMS
A. W. H. Carter *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 2 p (See N69-24401 12-08)
Avail: CFSTI

The application of new technologies to produce improved mobile radar data handling systems at reduced costs is investigated. Larger integrated circuit elements, known as medium scale integration (MSI) and large scale integration (LSI), are proposed. Possible advantages for such systems include the elimination of the need to redesign circuit elements as variations in system capacity are required, the prospect of computerized design evaluation prior to building the prototype, and additional gates for performing functions previously relegated to manpower. Two current mobile radar data handling systems, based on the use of discrete components, are compared with a 1970 system using integrated circuits. Major differences are shown in packaging methods. It is concluded that the real value of MSI/LSI can be achieved only by system concepts requiring a new appraisal of operational needs, a requirement which is reinforced by facts relating to cost, weight, and power of a system as a function of MSI/LSI. P.A.B.

N69-24423# Naval Air Development Center, Johnsville, Pa.
DATA HANDLING TECHNIQUES FOR LIGHT ATTACK AIRCRAFT
Robert Y. Beesburg *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 2 p (See N69-24401 12-08)
Avail: CFSTI

The integration of avionics equipments of the magnitude carried in modern light attack aircraft into a reliable and effective system is discussed. In the initial design of such a system, effort must be expended to ensure that the amount of information displayed to the pilot is sufficient for the successful completion of his mission. The transmission of the data from the sensors to the displays is a critical portion of the overall avionics system. The data transmission system must be designed with reliability, maintainability, flexibility, and cost as controlling factors. Data transmission type, control, channels, format, and reliability are considered, along with computer memory requirements. Author

N69-24456# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
A SYSTEM FOR MULTIDIMENSIONAL ANALYSIS [UN SISTEMA DI ANALISI MULTIDIMENSIONALE]
F. Panderese and M. Spinetti 28 Nov. 1968 11 p refs In ITALIAN
(LNF-68/71) Avail: CFSTI

A system for data analysis using the memory spaces with a minimum of time loss for data acquisition is studied. A block diagram is presented of the system which consists of four analog to digital converters of 128 channels, and an auxilliary circuit for processing four bits of binary information. Characteristic times for data processing are listed. An application of the system to analyze the photoproduction of mesons from hydrogen using Cerenkov counters is described. Block diagrams are included on the programs for activation and selection of data, for printing bi-dimensional measurements, for calibration, and for printing modified dimensional measurements. Transl. by F.O.S.

N69-24461# Joint Publications Research Service, Washington, D.C.
SOME PROBLEMS IN COMPUTER PROCESSING OF STATISTICAL INFORMATION
V. Greysukh 7 Apr. 1969 8 p Transl. into ENGLISH from Vestn. Statist. (Moscow), Jan. 1969 p 58–63
(JPRS-47794) Avail: CFSTI

Artificial methods of compressing information are reviewed; the method of abbreviation for forming a common code from a sequence of codes is outlined, and formulas for estimating the quantity of information or for measuring variety are given. The value of approximations in quantity estimates, as applied to statistical sampling data, is investigated. The opinion that statistical computation problems are algorithmically simple, containing only elementary arithmetical operations, is treated as erroneous. Work on the mathematical framework for conversion of economic information is considered, the purpose being to give economists a convenient means of dealing with computers and to study the principles governing computer processing of statistical data. The set of procedures of the formal framework of processing statistical information is discussed in terms of specific problems, such as convolution and unification. By compiling a program from optimum subprograms and using the principle of transition from disposition to algorithm in conformity with the technical characteristics of computers, an optimum statistical information processing program can be produced. A draft was also drawn for a language to describe conversions of statistical information. P.A.B.

N69-24468# System Development Corp., Santa Monica, Calif.
SOME RECENT CONTRIBUTIONS TO COMPUTER PROGRAMMING MANAGEMENT
Edward A. Nelson 16 Apr. 1968 46 p refs Presented at the Assoc. for Computing Machinery Meeting, Las Vegas, 1968
(AD-680105; SP-3122) Avail: CFSTI CSCL 9/2

The System Development Corporation has been conducting research in the management of the computer programming process since 1963. This paper briefly describes some of the results of this research, plus individual research by the author, and the relevance and usefulness of the results to the operating manager. The paper emphasizes four specific types of management tools that were produced: (1) planning aids; (2) cost estimating guides; (3) a project reporting and control system; (4) a technique for evaluating the effectiveness of certain classes of computer-centered information systems. Each of these tools is briefly described, and the research design and procedures used in their development are mentioned. The experience gained in applying traditional research techniques to the computer programming process has yielded certain insights regarding the economic and management dimensions of computer programming, and several of these insights are discussed. Foremost among this authors conclusions is that the management principles that apply to any other coordinative activity are equally applicable to the computer programming process. Specific techniques may differ, especially at the lower echelons, but these differences pertain to the technical skills and procedures of the production process, they are engineering, not management or economic issues. The paper concludes with several general observations pertinent to future research in computer programming economics and management, and the use of the management tools described. Author (TAB)

N69-24472# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INITIAL DESIGN FOR INTERFACE MESSAGE PROCESSORS FOR THE ARPA COMPUTER NETWORK
Jan. 1969 82 p
(Contract DAHC15-69-C-0179; ARPA Order 1260)
(AD-682905) Avail: CFSTI CSCL 9/2

The basic function of the IMP computer network is to allow large existing time-shared (Host) computers with different system configurations to communicate with each other. Each IMP (Interface Message Processor) computer accepts messages for its Host from other Host computers and transmits messages from its Host to other Hosts. Since there will not always be a direct link between two Hosts that wish to communicate, individual IMPs will, from time to time, perform the function of transferring a message between Hosts that are not directly connected. This then leads to the two basic IMP configurations -- interfacing between Host computers and acting as a message switcher in the IMP network. The message switching is performed as a store and forward operation. Each IMP adapts its message routine to the condition of those portions of the IMP network to which it is connected. IMPs regularly measure network performance and report in special messages to the network measurement center. Provision of a tracing capability permits the net operation to be studied comprehensively. An automatic trouble reporting capability detects a variety of network difficulties and reports them to an interested Host. An IMP can throw away packets that it has received but not yet acknowledged, transmitting packets to other IMPs at its own discretion. Self-contained network operation is designed to protect and deliver messages from the source Host to the destination Host. Author (TAB)

N69-24486# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE QUESTION OF CALCULATING THE RELIABILITY OF ELECTRONIC COMPUTERS
I. M. Malikov Jul. 1967 19 p refs Transl. into ENGLISH from Tr. Leningr. Inzhekon. Inst. (USSR), No. 55, 1965 p 79–84
(AD-673162; FTD-MT-67-13) Avail: CFSTI CSCL 9/2

Computer reliability is one of the major problems in computer technology today. The computer BESM, Strela, Ural and others have insufficient reliability. In the average month, three to nine percent of the elements will usually fail or be out of commission. Reliability criteria are discussed. The problem of aging and dependent parameters are mentioned. The notions of statistical and dynamic reliability are also explained. Calculations of computer reliability are given. Author (TAB)

N69-24489# Stanford Univ., Calif. Dept. of Computer Science.
THE PROBLEM OF SUBSTITUTION
Anthony C. Hearn Dec. 1968 15 p refs Presented at IBM Summer Inst. on Symbolic Math. by Computer, Boston, Jul.–Aug. 1968
(Contracts F44620-68-C-0075; SD-183)
(AD-680072; AI-Memo-70) Avail: CFSTI CSCL 9/2

One of the most significant features of programs designed for non-numeric calculation is that the size of expressions manipulated, and hence the amount of storage necessary, changes continually during the execution of the program. It is therefore usually not possible for the user to know ahead of time just how much output his program will produce, or whether the calculation will in fact fail because of lack of available computer memory. The key to keeping both the size of intermediate expressions and output under control often lies in the manner in which substitutions for variables and expressions declared by the programmer are implemented by the system. In this paper various methods which have been developed to perform these substitutions in the authors own system REDUCE are discussed. A brief description of the REDUCE system is also given. Author (TAB)

N69-24509# California Univ., Berkeley. Lawrence Radiation Lab.
AUTOMATIC SCAN
Joan Franz 28 Oct. 1968 8 p ref Presented at the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers, Argonne, Ill.
(Contract W-7405-eng-48)
(UCRL-18548; Conf-681025-11) Avail: CFSTI

The automatic scan program (516) is a C-level 7094 program which reads a data abstract tape and selects events, assigns event types, and edits data onto magnetic tapes in the standard HAZE format. The data abstract tape, which is a result of A and B-level DAPR program operation, contains track coordinates for each view and a list of tracks associated with each special vertex. In selecting events, straight-forward programming techniques are applied to impose a physics selection criteria upon the data. The program outputs a DAPR scan report which lists the selected events by frame and vertex location. If a manual pre-scan tape is also input, the DAPR scan report will list pre-scan comparisons. The method by which the program selects events from the data abstract tape is described. In order to discuss the method, the nature of the selection criteria is first considered. Author (NSA)

N69-24509# Sandia Corp., Albuquerque, N. Mex.
DIFOUT: A MODEL FOR COMPUTATION OF AEROSOL TRANSPORT AND DIFFUSION IN THE ATMOSPHERE
R. E. Luna and H. W. Church Jan. 1969 67 p refs
(SC-RR-68-555) Avail: CFSTI

The theory and use of DIFOUT, a computer-programmed model for prediction of transport and diffusion of aerosol clouds, is explained. An illustrative problem is worked to display the scope of inputs the model will accept. Author (NSA)

N69-24543# RAND Corp., Santa Monica, Calif.
THE INTEGRATED GRAPHICS SYSTEM FOR THE S-C 4060. 1: USER'S MANUAL
G. D. Brown, C. H. Bush, and R. A. Berman Dec. 1968 117 p refs
(Contract F44620-67-C-0045)
(AD-682505; RM-5660-PR) Avail: CFSTI CSCL 9/2

The report is a description of the S-C 4060 version of the Integrated Graphics System (IGS), a machine- and device-independent software package. The S-C 4060 stored-program graphical recording system consists of a small special-purpose computer, called the Product Control Unit (PCU); a high-precision cathode ray tube (CRT); a camera; a film developer; a hardcopy unit. IGS is programmed in FORTRAN IV, with special facilities for manipulating a single character in any position. IGS can be called by programs in FORTRAN, PL/I, and SIMSCRIPT, as well as machine language. On command, it draws lines and circles, plots points, composes text and tables with headings, and creates linear or nonlinear graphs. One subroutine draws an entire graph to fit given data, with a single call. Only parameters of interest need be specified; IGS automatically provides default values for character size, spacing, line spacing, and other format details. IGS accepts user coordinates and translates them into internal units. It automatically rescales graphical data to fit available space, converts graphical to numerical data, etc. The report includes an alphabetical index of subroutines, a listing of them by type, and a detailed description of each. Author (TAB)

N69-24548# International Business Machines Corp., Hopewell Junction, N. Y. East Fishkill Lab.
MULTIPURPOSE LOGIC CELL STUDY Final Scientific Report, 11 Sep. 1967 - 11 Oct. 1968
Ronald Waxman, Richard Preuss, Maurice T. Mc Mahon, Jr., Dennis Boreck, and Laurence Liang Oct. 1968 88 p refs
(Contract F19628-67-C-0302)
(AD-680404; AFCRL-68-0594) Avail: CFSTI CSCL 9/5

The objective of this study is to analyze a unique universal cell or cell set of logical equivalence and the application of this concept to Large Scale Integration (LSI). The study utilizes highly-automated computer techniques on selected logical graphs to generate the Boolean functions representing the logical graphs, and to catalog these functions into discrete classes. A cell set containing one or more function types can then be selected and automatically imposed on the original logic graphs for evaluation. The automated system is set up to allow rapid evaluation of parameter changes such as cell size and number of cell types. A large high-performance machine and a small low performance machine were analyzed, and a cell set was chosen for each machine. Results are shown in terms of cell usage, circuit usage and wiring histograms. Author (TAB)

N69-24549# Columbia Univ., New York. Dept. of Electrical Engineering.
STUDY OF A COMPUTER FOR DIRECT EXECUTION OF LIST PROCESSING LANGUAGE Final Report, Dec. 1965-Oct. 1967
T. R. Bashkow, D. Kroft, and A. Sasson Jan. 1968 161 p refs
(Contract AF 19(628)-5664)
(AD-680399; AFCRL-68-0063; TR-103) Avail: CFSTI CSCL 9/2

In recent years, list processing languages have been found useful in a variety of non-numerical applications of computers. These languages assume that data is structured in the form of simple or complex lists (i.e. lists of lists, etc.) rather than in simple vector or matrix-like arrays. Current languages also assume that such lists are stored in conventional location-addressable memories. This research demonstrates (a) the utilization of hardware, rather than software, for the interpretation and execution of list languages (b) the employment of a content-addressable or associative memory for the storage of lists and operating instructions or definitions and (c) the design of two list processing languages based entirely on (a) and (b) above. Systems designs of the two machines with only associative memories which directly interpret and execute the two list languages is given. The first language is developed from the basic DLM (i.e. Distributed Logic Memory - an associative memory) commands; the second from an existing language in which all major operations are determined by definitions stored in memory. The design information is presented in the form of Mealy state diagrams. Author (TAB)

N69-24550# System Development Corp., Santa Monica, Calif.
MECHANICAL ANALYSIS OF ENGLISH CARDINAL NUMERAL EXPRESSIONS
James R. Hurford 30 Aug. 1968 30 p refs
(AD-680104; SP-3211) Avail: CFSTI CSCL 5/7

The document illustrates the working, from a users point of view, of the Protosynthex III semantic analysis machine. The vehicle for the illustration is the English system of cardinal numeral expressions, such as three hundred and twenty-six or two hundred thousand. Various structural curiosities of this system and of the semantic analysis algorithm are discussed. The machines success in deriving unique intuitively acceptable deep structures for cardinal numeral expressions is demonstrated. Author (TAB)

N69-24556# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
DISCRETE RENEWAL PROCESSES
Michael Muntner Dec. 1968 26 p refs
(Contract DAHC15-67-C-0011)
(AD-680599; RP-P-413) Avail: CFSTI CSCL 9/4

Discrete renewal process, until recently, have not been applied to the mathematical modelling of physical processes. Analyses of such renewal processes have proceeded on the basis of generating functions but the results are often too complicated to be of use. This paper presents an alternative approach to discrete renewal theory and calculates many of the more complex statistics of such processes. Author (TAB)

N69-24557# Auburn Univ., Ala.
INFORMATION PROCESSING Annual Report, 15 Sep. 1967–30 Sep. 1968
Charles R. White, Joe H. Mize, William H. Bussell, George H. Brooks, Leland H. Williams et al Oct. 1968 268 p refs
(Contract DAAH01-68-C-0296; Proj. Themis)
(AD-680304; AV-T-2; AR-1) Avail: CFSTI CSCL 9/2

Information processing research has included the development of a computer program which successfully simulates a production control system. A manual for student use with this system has been developed. Also, a number of computer programs capable of extending the mechanical designers ability have been written. A program which uses the computer as a symbol manipulator to assist in solving systems of polynomial equations has been extended and developed. In addition, a complete report has been prepared on An Algorithmic Approach to Sequential Automata Design. Author (TAB)

N69-24628# Technical Univ. of Norway, Trondheim. Dept. of Production Engineering and Machine Tools.
MATHEMATICAL METHODS IN PLANNING OF MACHINING OPERATIONS
Oeyvind Bjoerke and Bjoern Haugrud Sep. 1967 38 p refs Presented at CIRP Meeting, Ann Arbor, Mich., Sep. 1967
Avail: CFSTI

Algebraic topology, graph theory, and pseudo-Boolean programming are useful tools in planning and optimization of machining processes. It is stressed that all the information normally presented in the drawing has to be transferred explicitly into the computer. In order to store the structure of the product specification in the computer, incidence matrices are used. The planning problem is to select a sequence of machining operations, including selection of measuring devices and cutting tools, in order to obtain the minimal manufacturing cost. Before the optimization is performed, a list of the machining operations and calculations of the cost of each are presented. The mutual relationships of the operations are expressed as a graph. The cost of the process is expressed as a pseudo-Boolean function which is minimized using pseudo-Boolean programming. The graph is transformed into pseudo-Boolean relations which are constraints in the minimization problem. Other constraints are imposed by the tolerances given in the drawing. Author

N69-24679# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING MACHINES AND THEIR OPERATION (SELECTED CHAPTERS)
G. P. Evstigneev and N. F. Uskov May 1968 77 p refs Transl. into ENGLISH from Schetnye Mashiny i Ikh Eksploatatsiya (Moscow), 1964 p 96–409
(AD-680647; FTD-HT-67-381) Avail: CFSTI CSCL 9/2

A description of the design and operating principles of keyboard calculating and punching machines used for the mechanization of calculation and computer operations is presented. Also a description of the methods and operation processes of these machines is given. The following subjects are covered in the selected sections from Chapters 5, 8, 9, 10, 11 and 13 of this book: (a) Askota 170/55 machine; (b) PD-45 two-period keypunch; (c) PBO-6 Keypunch; (d) KBO-6 verifier; (e) sorting machines; (f) RPM80-2M (RPM45-2M) distributing-sorting machine; (g) T-5M tabulator; (h) information on totalizing punchers; (i) function of patch-board jacks; and (j) description of some of the most recent calculating machines and general trends in their development. Author (TAB)

N69-24702# White Sands Missile Range, N. Mex. Atmospheric Sciences Research Office.
THE HULL OF A CHANNEL
Louis D. Duncan and Walter B. Miller Sep. 1968 23 p refs
(AD-680173; ECOM-5218) Avail: CFSTI CSCL 9/4

A channel is identified, in a natural way, with a subset (the fundamental measures) of the normed linear space of all totally finite signed measures on a given measurable space (the channel output space). With this consideration, it is natural to define the hull of a channel to be the convex hull of the fundamental measures. The hull is said to be generated by the fundamental measures. It is shown that any channel which generates the hull has the same capacity as the hull itself. Finally, it is shown that the coding theorem and the strong converse hold for the hull if and only if they hold for any channel which generates the hull. This immediately proves the coding theorem and the converse for any channel whose hull is finitely generated. Author (TAB)

N69-24712# Institut Fiziki Vysokikh Energii, Serpukhov (USSR).
MODIFICATIONS OF "MINSK-2" AND "MINSK-22" NECESSARY FOR THE WORK OF THE MONITOR
Yu A. Akimov, A. E. Belotsvetov, L. V. Belyaevskii, Yu. V. Mikhailov, and S. N. Sokolov 1968 21 p refs In RUSSIAN
(IFVE-SVM-68-44-K) Avail: AEC Depository Libraries

The usual stop instruction, due to an illegal instruction (pseudocode), overflowing, and a magnetic tape fault, is replaced by an interruption. Electronic clock and time interruption are added. The duration of the execution of an instruction as well as a call to an unswitched peripheral unit are controlled. The number of words input from punched tape is controlled. This additional circuitry gives the possibility to organize at a Minsk-22 computer a programmed diagnostics of overflowings and continuous chaining of jobs in the automat state by means of a monitor system of programs. Author (NSA)

N69-24744# Stanford Univ., Calif. Dept. of Computer Science.
THE KINEMATICS OF MANIPULATORS UNDER COMPUTER CONTROL
Donald Lee Pieper Oct. 1968 170 p refs
(Contract ARPA SD-183; ARPA Order 457)
(AD-680036; CS-116; AI-M-72) Avail: CFSTI CSCL 9/2

The kinematics of manipulators is studied. A model is presented which allows for the systematic description of new and existing manipulators. Six degree-of-freedom manipulators are studied. Several solutions to the problem of finding the manipulator configuration leading to a specified position and orientation are presented. Numerical as well as explicit solutions are given. The problem of positioning a multilink digital arm is also discussed. Given the solution to the position problem, a set of heuristics is developed for moving a six degree-of-freedom manipulator from an initial position to a final position through a space containing obstacles. This results in a computer program shown to be able to direct a manipulator around obstacles. Author (TAB)

N69-24748# Michigan State Univ., East Lansing. Div. of Engineering Research.
EFFECT OF SUBSYSTEMS INFORMATION FEEDBACK ON THE ENTROPY OF THE WHOLE SYSTEM. PART 2: TRANSFORMATION SCHEMES OF DISTINCT INFORMATION CHAINS Quarterly Scientific Report
M. Z. V. Krzywoblocki and Floyd E. Le Cureux Ft. Monmouth, N. J. ECOM Oct. 1968 54 p refs
(Contract DAAB07-67-C-0586)
(AD-680214; ECOM-0586-2; QR-2) Avail: CFSTI CSCL 9/4

This report represents the transformation schemes of an information system not connected directly with any particular physical system. In the present scheme the number of subsystems is unlimited, and the number of states is arbitrary. A transformation of the system from one state to another is not connected with any

physical phenomenon. The transformations of the entire system are arranged in a state-wise manner. All the additional operations such as regrouping, reordering, renormalization, and calculation of the sensitivity coefficients have to be performed between the particular states of the transformations of the entire system. For illustrative purposes, it is assumed that the information system consists of four subsystems, S1 to S4, each containing a certain number of distinct parameters together with a set of probabilities associated with each parameter. The probabilities are normalized to unity. After the initial state is closed, there takes place the transformation of the entire information system from S(0) to S(1). The transformation is a momentary process. The number of subsystems in S(1) does not necessarily need to be equal to the total number of subsystems. In the present scheme of the transformations it is necessary to record continuously, after each state, the past history of each parameter independently of the formalism of transformations. The parameters are shifted from one subsystem to another, and in their symbolic notations the origin of the parameter and its destination are not marked. The recording of the history of each parameter is an important item. This report presents the formalism of four transformation states. Author (TAB)

N69-24747# Michigan State Univ., East Lansing. Div. of Engineering Research.
EFFECT OF SUBSYSTEMS INFORMATION FEEDBACK ON THE ENTROPY OF THE WHOLE SYSTEM. PART 3: NUMERICAL EXAMPLES Quarterly Scientific Report
M. Z. V. Krzywoblocki, Y. K. Choo, and Floyd E. Le Cureux Nov. 1968 76 p refs
(Contract DAAB07-67-C-0586)
(AD-680215; SR-3; ECOM-0586-3) Avail: CFSTI CSCL 9/4

This report is concerned with a computer simulation of a transformation scheme of distinct information chains derived and constructed in AD-680 214. The report describes the computer formalism of the transfer of information from the initial state to successive states. The program is written in Fortran and includes several subroutines. The entire program refers to statistically independent subsystems. In the first part of the report there are constructed programs for general subroutines, applied to the case in question: the subroutine Constant, Random, and Mess Up. The flow charts of the computer program contain program Message, subroutine ENTV, subroutine ENTT, ENTS, RANDOM, PRT, etc. The programs are used to calculate numerically a few examples with completely arbitrarily assumed probability values. Two numerical examples are calculated following exactly the formalism and the sequence developed and constructed in AD-680214. The calculations give the values of the entropies, sensitivity coefficients, etc. The last numerical example solved refers to the target recognition problem. In this example there are calculated the magnitudes of entropies in various environmental conditions. Author (TAB)

N69-24748# Michigan State Univ., East Lansing. Div. of Engineering Research.
EFFECT OF SUBSYSTEMS INFORMATION FEEDBACK ON THE ENTROPY OF THE WHOLE SYSTEM, PART 4 Final Report
M. Z. V. Krzywoblocki, Y. K. Choo, and Floyd E. LeCureux Dec. 1968 14 p refs
(Contract DAAB07-67-C-0586)
(AD-680216; ECOM-0586-F-Pt-4) Avail: CFSTI CSCL 9/4

The portion of the project reported refers to the summary of the work done in the three previous reports. TAB

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N69-23417*# TRW Systems Group, Redondo Beach, Calif.
ANALYSIS OF AEROSPACE POWER CONDITIONING COMPONENT LIMITATIONS Final Report
B. F. Farber Apr. 1969 374 p refs
(Contract NAS7-546)
(NASA-CR-97000; TRW-09024-6001-RO-00) Avail: CFSTI CSCL 09A

The performance of power conditioning equipment aboard space vehicles and in critical aerospace applications can be improved through advancements in circuit design techniques and through the availability of new or improved circuit components (piece parts). In this study the relationship between component limitations and the weight, reliability, and efficiency of transistorized power conditioning networks, typical of state-of-the-art power conditioning, is quantitatively examined. The potential benefit to be derived from assumed incremental improvements in components is calculated with power subsystem weight used as the principal figure-of-merit. Author

N69-23556*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
DEVELOPMENT OF AN EXPERIMENTAL SILICON CARBIDE BACKWARD DIODE OPERABLE TO 1000°K
Richard Farrell Washington Apr. 1969 7 p refs
(NASA-TN-D-5183) Avail: CFSTI CSCL 09A

Silicon carbide backward diodes which operate between 77°K and 1000°K were developed. Figures of merit ($\gamma \sqrt{R}$) of 19,300, 3,960, and 15 at 12.5 MHz, 50 MHz, and 8.8 GHz, respectively, were measured with detector areas on the order of 10^{-5} cm^2. These results are compatible with a prior analysis which predicts an upper frequency limit of between 0.1 and 1.0 GHz for SiC backward diodes. Author

N69-23590 Missouri Univ., Rolla.
ANALYSIS OF A FOCUS LOG ELECTRODE IN A NON HOMOGENEOUS MEDIUM
John Julian Zenor (Ph.D. Thesis) 1968 78 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-14049

A mathematical model is presented for the focused logging systems which is applicable to any resistance logging tool of the electrode type. The tool and its environment are compartmentalized, and the integral form of the condition for continuity of current is applied to each compartment. Acceleration methods are applied to the iterative solution of the resulting large-scale system of linear equations. Two specific models are presented, one for the study of the effects of invasion and the other for the study of the effects of bed thickness on the apparent resistivity readings of the tool. Dissert Abstr.

N69-23612 IIT Research Inst., Chicago, Ill.
R-C ACTIVE BAND-PASS FILTER SYNTHESIS
Howard Francis Prosser (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-14916

A synthesis technique is presented for the design of active R-C bandpass filters with prescribed frequency characteristics that is as systematic as is the synthesis of lossless bandpass filters. The method differs from other active R-C synthesis techniques in that it

provides for the synthesis of a low-frequency band-pass prototype filter (of a given Q) which may be cataloged. These prototypes have a center frequency of one radian per second and element values in the order of magnitude one which make calculations simple and frequency and impedance level denormalization very convenient. Dissert. Abstr.

N69-23625*# Norton Research Corp., Cambridge, Mass.
CONSTRUCTION OF A BREADBOARD ELECTRONICS SYSTEM FOR A LIGHT WEIGHT COLD CATHODE QUADRUPOLE MASS SPECTROMETER Final Report, 11 Dec. 1967–10 Oct. 1968
J. R. Roehrig 10 Oct. 1968 39 p
(Contract NAS1-5347)
(NASA-CR-66763) Avail: CFSTI CSCL 09E

A light weight low power electronics system has been developed and constructed in breadboard form to operate a small cold cathode ion source quadrupole mass spectrometer. The system operates from 28 volts d.c. primary power with a mass range of 1–50 amu and a resolution of 1.2 amu in a pressure range of 10^{-9} to 10^{-4} Torr. The mass range may be scanned in five seconds or slower as required. The complete system weighs 4 lbs. 15 oz. and requires an average power of 11 watts. Author

N69-23700*# North Star Research and Development Inst., Minneapolis, Minn.
RESEARCH INTO THE FEASIBILITY OF THIN METAL AND OXIDE FILM CAPACITORS
M. E. Browning, G. V. Jorgenson, and W. H. Graves Jun. 1968 81 p refs
(Contract NAS12-551)
(NASA-CR-86140) Avail: CFSTI CSCL 09A

Low energy RF sputtering and vacuum evaporation were used to investigate the feasibility of producing thin metal and oxide film capacitors. Dielectric material systems selected for the study included SiO_2 and Al_2O_3, and aluminum and tantalum were examined for the electrodes. The SiO_2 and Al_2O_3 capacitors were found to operate effectively at temperatures as high as 300°C, and, in several systems, did not change electrical properties appreciably at temperatures as high as 500°C. The changes that did occur at 500°C were always reversible. Three model capacitors were prepared with interconnected layers having a cumulative volume exceeding 0.5 cubic centimeter of material. The electrical test characteristics of thin film SiO_2 capacitors were excellent from -60° to above 300°C, for frequency ranges from 200 to 100,000 hertz. These capacitors demonstrated the feasibility of making planar capacitors that at 300°C had energy densities of 25 joule per kg and dissipation factors of 3×10^{-3}. Author

N69-23749 Rensselaer Polytechnic Inst., Troy, N. Y.
A DEVICE MODEL FOR JUNCTION-GATE FIELD EFFECT TRANSISTOR
Alan Bekir Grebene (Ph.D. Thesis) 1968 184 p
Avail: Univ. Microfilms: HC $8.40/ Microfilm $3.00 Order No. 68-13512

A physical model was developed which is valid over the entire dynamic range of operation and provides a complete description of the physical phenomena responsible for current saturation. It is shown that for drain-to-gate voltages in excess of the device pinchoff voltage, the current conduction mechanism through the transistor can be analyzed in terms of a two region model by treating the channel as made up of two separate sections. The model was initially developed for field effect transistors with uniformly doped channel regions and abrupt gate-channel junctions, but was extended to generalized device structures with arbitrary impurity profiles. It is shown that the basic features of the model are independent of the channel impurity distribution for physically realizable doping profiles. A graphical design and analysis technique was developed for devices of arbitrary complexity. In the experimental verification of the model, double-diffused and expitaxial channel silicon transistors of various geometries were employed as test units. In all cases, a close correlation was obtained between the predicted and observed results. Dissert. Abstr.

N69-23809*# Radio Corp. of America, Somerville, N. J. Electronic Components.
DEVELOPMENTAL PROGRAM FOR 8-WATT, 2.3-GIGAHERTZ, n-p-n, SILICON TRANSISTOR Final Report, 12 Oct. 1966–30 Oct. 1968
G. Hodowanec and D. S. Jacobson 30 Oct. 1968 89 p refs
(Contract NAS5-10066)
(NASA-CR-100728) Avail: CFSTI CSCL 09A

A silicon, overlay, microwave transistor, the TA7205, that delivers 6 watts of output power at 2.3 gigahertz with 5-dB power gain and 50 percent collector efficiency was designed and developed. This performance was obtained with the transistor operating in the common-base mode as a Class-C amplifier from a 28 volt power supply. To achieve the above performance, a hermetic coaxial package capable of efficient operation at microwave frequencies up to 2.5 gigahertz was designed and developed. The excellent performance of the TA7205 as a microwave amplifier was attributed to the use of an advanced overlay surface geometry containing 0.07-mil-wide emitter sites, and to the application of diffusion techniques required to achieve very narrow base widths. Typical performance of the hermetic coaxial-packaged transistors was 5 watts of output power at 2.3 gigahertz with 4.7-dB gain and 45-percent collector efficiency. Author

N69-23972# Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.
FIVE PORT BEAM SWITCHING MAGNET FOR USE WITH 5.5 MeV VAN de GRAAFF ACCELERATOR
T. P. David, N. Sarma, P. R. Sunder Rao, and M. Bhatia 1968 30 p
(BARC-372) Avail: CFSTI

The bending analyzing magnet used with the 5.5 MeV Van de Graaff Accelerator at Trombay is designed for rotation in any desired direction. As originally intended experiments at different areas would be set up in the beam room and this magnet would be aligned to direct the beam to the target chamber of any experimental arrangement. However, in practice it was found that this process is very tedious and time consuming, since the vacuum system has to be disconnected and air let in to the beam tube before the magnet is rotated. After connecting a new experimental set up it took a long time, sometimes up to a couple of days, before the beam could be fully aligned on to the target in the chamber. A magnet was adapted and installed beyond the analyzing magnet to switch the beam into any one of these ports which considerably reduced the time to change over from one experiment to another. A five-port switching magnet has been designed and fabricated along with the necessary stabilized power supplies. Author

N69-24083*# Texas Instruments, Inc., Dallas. Components Group.
DEVELOPMENT OF A MICROELECTRONIC MODULE Final Report
H. Strack, F. Doerbeck, E. Harp, and E. Mehal Nov. 1968 109 p refs
(Contract NAS12-537)
(NASA-CR-86144) Avail: CFSTI: CSCL 09A

To assess the feasibility of operating GaAs devices in high temperature microelectronic circuits, thick film and thin film circuits were fabricated using GaAs transistors and diodes. High temperature properties were compared for GaAs n-p-n and p-n-p devices, and GaAs Schottky-barrier field effect transistors. The GaAs diodes were

diffused into p-type and n-type GaAs to evaluate the dependence of the high temperature voltage–current characteristics on fabrication methods. Variations in substrate materials, doping elements, and transistor fabrication were introduced to find out whether the high temperature performance of GaAs devices depends on fabrication techniques for device and material or is related to GaAs as such. Results show that high temperature electronic microcircuits are affected by the performance of both the active elements and the passive components. It was concluded that high temperature electronics requires not only new technologies for active devices but also improved technologies for passive components, encapsulations, circuit fabrication, and testing. Author

N69-24135# Royal Aircraft Establishment, Farnborough (England).
THE TEMPERATURE SENSITIVITY OF A COMMERCIAL METAL FILM RESISTOR
J. A. Andrew Jul. 1968 16 p refs
(RAE-TR-68177) Avail: CFSTI

The temperature coefficient of a commercial metal film resistor has been investigated over a temperature range of 25°C to 50°C. It has been found to have a magnitude of less than ±1.5 ppm/C deg which upholds the manufacturer's claim. Author (ESRO)

N69-24136# Royal Aircraft Establishment, Farnborough (England).
FAILURE ANALYSIS OF SEMICONDUCTOR INTEGRATED CIRCUITS
P. J. Holmes and I. C. Jennings Jun. 1968 38 p refs
(RAE-TR-68148) Avail: CFSTI

The techniques of failure analysis on integrated circuits in various encapsulations are outlined, and a number of actual failures are described. Some of the tests available are potentially more destructive or more liable to give ambiguous results with integrated circuits than with individual transistors. The continued prevalence of bonding faults and other defects of manufacture is noteworthy, and suggests that mere knowledge of what can go wrong is unlikely to make much impact on the reliability problem unless it results in positively improved process controls. Author (ESRO)

N69-24219# Radio Corp. of America, Princeton, N. J.
INTEGRATED LOGIC NETWORKS Final Report, 1 Mar. 1967–30 Sep. 1968
James F. Allison Oct. 1968 35 p refs
(Contract F19628-67-C-0290)
(AD-680411; AFCRL-68-0516) Avail: CFSTI CSCL 9/5

This report describes research into the properties and uses of thin films of silicon-on-sapphire with emphasis on the development of high-speed complementary-symmetry MOS integrated circuits. The nucleation rate during the growth of the films was found to greatly affect the film properties. A comparison of diodes fabricated in silicon-on-sapphire and diodes fabricated in silicon-on-spinel (magnesium-aluminate) is made, indicating that some advantages may be realized by the use of spinel substrates. The results of the investigation into the shape of the edge of silicon etched in various etchants are presented. The use of the scanning electron microscope (SEM) has yielded invaluable information into the details of the shape of the edge which cannot be discerned with optical microscopy. Techniques are described which allowed the successful fabrication of a pattern containing 62,500 crossovers. The fabrication of high-speed nondestructive readout memory cells, exhibiting a read/write cycle time of 5 nsec, and the fabrication of a 5-stage ring oscillator are described. The latter operates at a frequency of 32 MHz at 4.5 V, which indicates a pair-delay of approximately 1 nsec. Author (TAB)

N69-24317*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
LOW POWER DRAIN SEMI-CONDUCTOR CIRCUIT
Ciro A. Cancro, inventor (to NASA) Issued 4 Feb. 1966 (Filed 3 Jan. 1966) 8 p Cl. 307-268
(NASA-Case-XGS-04999; US-Patent-3,426,219; US-Patent-Appl-SN-519395) Avail: US Patent Office CSCL 09A

A solid state low power drain circuit is described which generates an output pulse with width independent of input pulse width. A transistor constant current source drives a tunnel diode, the output being fed back to the input. By controlling the relative amplitudes of the input pulse and the feedback signal, the circuit may be made to act as a frequency limiter or gated oscillator. The circuit also provides a delayed output. Official Gazette of the U.S. Patent Office

N69-24318*# Radio Corp. of America, New York.
APPARATUS FOR BALLASTING HIGH FREQUENCY TRANSISTORS
George J. Gilbert, inventor (to NASA) Issued 25 Feb. 1969 (Filed 31 Aug. 1966) 5 p Cl. 317-235
(NASA-Case-XGS-05003; US-Patent-3,430,115; US-Patent-Appl-SN-576797) Avail: US Patent Office CSCL 09A

A contract and lead arrangement is developed for multiple junction planar transistors. It consists of a plurality of separate leads connected one for one to each U-shaped contact member of each of a pluraility of pairs of interleaved U-shaped contact members. The length of each separate lead is predetermined to provide a desired value of inductance at the operation frequency. Official Gazette of the U.S. Patent Office

N69-24324*# Hughes Aircraft Co., Culver City, Calif.
VARACTOR HIGH LEVEL MIXER
Nicholas J. Penque and Harold A. Rosen, inventors (to NASA) (Issued 8 Apr. 1969 (filed 26 Oct. 1966) 7 p Cl. 325-446
(NASA-Case-XGS-2171; US-Patent-3,437,953; US-Patent-Appl-SN-590159) Avail: US Patent Office CSCL 09A

A stripline mixing circuit is described wherein a primary frequency signal is applied to a hybrid which splits the signal and applies each of the resultant signals through a high pass filter to a varactor mixing diode. Secondary frequency signals are applied through low pass filters to each of the diodes. The heterodyned signals are reflected back through the high pass filters to the hybrid. Official Gazette of the U.S. Patent Office

N69-24329*# Kinelogic Corp., Pasadena, Calif.
EXCITATION AND DETECTION CIRCUITRY FOR A FLUX RESPONSIVE MAGNETIC HEAD
David A. Ehrenfeld, inventor (to NASA) Issued 18 Feb. 1969 (Filed 26 Apr. 1966) 11 p Cl. 179-100.2 Prepared for JPL
(Contracts NAS7-100; JPL-950850)
(NASA-Case-XNP-4183; US-Patent-3,428,761; US-Patent-Appl-SN-546142) Avail: US Patent Office CSCL 09A

An excitation and detection circuit is developed for use with a flux responsive magnetic head. By employing the techniques of this invention, a magnetic head is excited during sampling periods occurring at a selected rate rather than continuously. This results in much lower power requirements. Also, the excitation during discrete sampling periods enables the use of flip-flop circuitry so that the core of the magnetic head is driven to saturation at the end of each sampling period, thereby eliminating the need for a separate dc bias source. NASA

N69-24330*# Sperry Gyroscope Co., Great Neck, N. Y.
AUTOMATIC GAIN CONTROL SYSTEM

Stanley H. Black, inventor (to NASA) Issued 18 Feb. 1969 (Filed 23 Dec. 1965) 5 p Cl. 330-29
(NASA-Case-XMS-5307; US-Patent-3,428,910; US-Patent-Appl-SN-516154) Avail: US Patent Office CSCL 09A

An automatic gain control (AGC) system is developed for attenuating input signals over a wide range of signal levels to prevent overloading the output stage of a receiver system. RF input signals are coupled to a diode network attenuator, the output of which is coupled to a reflex amplifier. A dc control voltage proportional to the signal amplitude in the last amplifier of the receiver in which AGC system is to be used is coupled to a dc input terminal of the reflex amplifier. The dc output voltage of the reflex amplifier is applied through an L-C network to an AGC control amplifier, the output of which is coupled to a control terminal of the attenuator network. The RF output signal is taken from RF output terminal of the reflex amplifier. As the amplified dc control voltage is varied, the system operates to keep the RF output voltage of the last stage relatively constant by causing more or less attenuation to be inserted by the electrically controlled attenuator.
Official Gazette of the U.S. Patent Office

N69-24333*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TELEMETRY WORD FORMING UNIT
Hoyt Holmes Nelson, inventor (to NASA) Issued 4 Mar. 1969 (Filed 17 May 1967) 14 p Cl. 340-172.5
(Contract NAS7-100)
(NASA-Case-XNP-9225; US-Patent-3,431,559; US-Patent-Appl-SN-640785) Avail: US Patent Office CSCL 09A

A unit is described for use with and between a telemetry demodulator and a computer. It receives telemetry data to form the data into discrete multibit words. The unit includes a counter resettable at any count up to 11, a register and SYNC-word detecting circuit, each of 11 bits which equal the bit length of each telemetered data word. Data bits from the demodulator are transferred bit by bit to the register in the unit and transferred to the computer as groups of 11 bits when the count in the counter reaches 11 or when the 11 bits in the register (in conjunction with the SYNC-word detecting circuit) are indicative of the SYNC word assumed to be telemetered. The computer uses the count in the counter when a SYNC word is recognized to redistribute previously received bits into discrete 11-bit data words.
Official Gazette of the U.S. Patent Office

N69-24369# Army Electronics Command, Fort Monmouth, N. J.
FLAT PANEL DISPLAYS
Mortimer H. Zinn and Elliot Schlam Dec. 1968 15 p ref
(AD-680194; ECOM-3045) Avail: CFSTI CSCL 9/5

The electronic display up to this date has been based primarily on the use of the cathode-ray tube. While this device has many meritorious features, it requires a high ratio of depth to display area diagonal for adequate displays. This is particularly true in many military applications. The usual military need to conserve volume and weight has, therefore, resulted in considerable emphasis on achieving flat panel displays. Many approaches have been pursued based on both light reflecting (or transmitting) and light generating approaches. The dc electroluminescent diode is a leading contender among the solid-state devices proposed for matrix displays. This may lead to a solution of particular display problems, but limitations in light output, persistence, and control characteristics together with cost indicate that other approaches should be continued to be considered. A flat panel display device based on the electron tube art but using matrix address techniques to produce an electron beam at the desired display point would solve some of these display problems. Realization of this device is dependent upon a suitable cathode. A design based on the field-emitting asperity in a cavity and one using photoemissive strips are outlined. Author (TAB)

N69-24375# Electro-Optical Systems, Inc., Pasadena, Calif.
CHARGE-CONTROLLED STORAGE DISPLAY PANELS Quarterly Report, 1 Feb.–30 Apr. 1968
D. Paul Foote and Benjamin Kazan Ft. Monmouth, N. J. ECOM Dec. 1968 36 p refs
(Contract DA-28-043-AMC-02482(E))
(AD-680190; EOS-7109-Q-7; ECOM-02482-7; QR-7) Avail: CFSTI CSCL 9/1

A new type of image panel design was evolved and successfully tested. The new panel employs an illuminated photoconductive layer, instead of corona discharge, to supply negative charge to the ZnO layer surface. By illuminating only selected areas of the photoconductor, erasure of corresponding areas of a stored image can be accomplished. In addition, positive or negative stored images may be produced from an input image depending on choice of the polarity of the potential applied to the photoconductor. A number of panel electrode structures including one with 100 lines per inch were produced on an improved type of tin oxide coated glass. These structures were essentially free of open circuited lines caused by pits and scratches such as frequently occurred on the old type of glass. Improved techniques for producing plastic substrate image panels, with emphasis on machining operations suitable for making large area panels were developed. New curing cycles for the epoxy bound powder layers used in this type of panel were developed in order to prevent loss of conductivity in the indium oxide layer. A 12 square inch plastic panel was fabricated and successfully operated. Author (TAB)

N69-24421# Air Force Systems Command, Wright-Patterson AFB, Ohio. AF Avionics Lab.
THE APPLICATION OF ADVANCED INTEGRATED CIRCUIT TECHNIQUES TO RADAR AND SENSOR DATA HANDLING
Howard H. Steenberger and Lutz J. Micheel *In* AGARD Tech. for Data Handling in Tactical Systems Nov. 1968 2 p (See N69-24401 12-08)
Avail: CFSTI

Recent developments in silicon integrated circuit technology are discussed, with interest in advanced military applications. Analog function generation and computation, advanced digital integration techniques, ultra-high speed arrays, real time digital video processing, and satellite data links are included. Future developments are then forecast. P.A.B.

N69-24428# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRON BEAMS AND ELECTRON GUNS
I. V. Alyamovskii Feb. 1968 383 p refs Transl. into ENGLISH from the book "Elektronnye Puchki i Elektronnye Pushki" Moscow, Sovetskoye Radio, 1966 p 1–456
(AD-680309; FTD-HT-23-1563-67) Avail: CFSTI CSCL 9/1

The volume sets forth the basic problems of shaping (focusing) high-intensity electron fluxes. The fluxes are considered in the region of a homogeneous, periodic and reversing magnetic field, in the transitional region of an inhomogeneous magnetic field, and in the collector region, and electron guns for shaping of axisymmetric, ribbon and tubular fluxes and guns with high perveance and strong convergence are considered. Electrostatic and ionic focusing are described. Circuits and examples are presented for the practically most important systems with longitudinal magnetic field.
Author (TAB)

N69-24457# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali de Frascati.
MAGNETO EXPERIMENTS WITH TRANSVERSE AND LONGITUDINAL SOLENOIDS [RELAZIONE SUL PROGETTO DEL MAGNETE PER ESPERIENZE CON ADONE DI TIPO SOLENOIDE TRASVERSALE E LONGITUDINALE]

A. Catitti and G. Pasotti 12 Dec. 1968 20 p refs In ITALIAN (LNF-68/72) Avail: CFSTI

Some general design considerations of magnetos with longitudinal and transverse solenoids are presented, and the principal experimental techniques are described. Structural details are given on the magnetos, with particular emphasis placed on the coil windings. Results of magnetic field measurements are tabulated. Transl. by F.O.S.

N69-24473# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE KLYSTRON

Ch'i Yao Jul. 1968 14 p Transl. into ENGLISH from Wu Hsien Tien (China), Vol. 22, No. 3, 1966 p 12–13

(AD-682970; FTD-HT-23-1575-67) Avail: CFSTI CSCL 9/1

A discussion is given of the functions and operational principles of klystrons, which are classified into direct beam type (two-cavity or multicavity) and reflex type (single cavity). Direct beam klystrons are used for oscillation, amplification, and frequency multiplication in the 10,000-Mc range to produce a pulse power output reaching tens of Mw and a power amplification near the million-fold mark. Klystrons cannot be used in receivers to amplify weak signals because of high inherent noise levels. Reflex klystrons are used only as oscillators, for example local oscillators in superheterodyne receivers or microwave signal generators in electronic equipment. Reflex klystron oscillators operate at a frequency up to 90,000 Mc. Internal and external resonant cavities are designed to meet specific tuning requirements. Author (TAB)

N69-24475# Technische Hochschule in Wien (Austria).

PULSATING ARCS IN CONTACTS [INTERMITTIERENDE BOEGEN IN KONTAKTEN]

Dieter Schuoecker (Ph.D. Thesis) Aug. 1968 194 p refs In GERMAN

Avail: CFSTI

Developed is a model for intermittent contact arcs in inductive circuits that form immediately after gaseous ignition and trigger contact voltage jumps to the operating voltage of the normal glow discharge. Thus, electrical capacity is added to the induction voltage and the electric discharge current increases rapidly. Current density and operating voltage of the glow discharge increase until the operating voltage reaches the capacitor voltage and decreases subsequently. When the optimal current density during discharge is above the current density required to change the glow discharge, an arc is formed with parallel capacity discharge. This theoretical model shows good agreement with the properties of intermittent arc discharges. Transl. by G.G

N69-24501*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

PULSE CIRCUITRY FOR A FLYABLE TIME-OF-FLIGHT MASS SPECTROMETER

R. B. Hazelton 10 Dec. 1968 52 p refs

(Grant NGR-39-009-032)

(NASA-CR-100770; SR-329(E)) Avail: CFSTI CSCL 09A

A method is presented for electronically sweeping the delay time between two pulses in order to provide sampling of the spectrometer's ion beam. This results in shifting the information content of the instrument's output to lower frequencies thus allowing the spectrometer to be used with simpler dc electrometer circuits. The circuitry was designed with emphasis on low power consumption and other factors which are desirable for rocket probes. Practical pulse and timing techniques are presented which may prove useful in other areas involving pulse circuitry. Author

N69-24586# Battelle-Northwest, Richland, Wash.

TRENDS IN LOW-LEVEL MULTIPLEXING

R. E. Mahan 13 Sep. 1968 45 p refs Presented at the IEEE Meeting, Richland, Wash., 24 Sep. 1968

(Contract AT(45-1)-1830)

(BNWL-SA-2085; Conf-680937-1) Avail: CFSTI

The state-of-the-art in low-level multiplexers as reported in currently available literature reveals that electromechanical commutators offer superior performance in most electrical performance categories. It should be stressed, however, that the degree of superiority is extremely small with regard to most parameters. Cost is the one parameter where electromechanical MUX's have a significant advantage. The primary defects in electromechanical MUX's are in sampling speed and long term reliability. Block switching offers an alternative to the speed limitation, but only if quasi-random access addressing can be tolerated. The closest competitor to electromechanical MUX's are the new FET MUX's which offer an order of magnitude higher speed and greater reliability, but currently cost about twice as much as comparable electromechanical systems. Electrical performance differences are modest with the one exception of common mode voltage protection. Author (NSA)

N69-24589# Army Electronics Command, Ft. Monmouth, N. J.

TECHNIQUE FOR LOCATING AND MAPPING THE SURFACE DENSITY OF MICRON-SIZED ASPERITIES USED AS COLD-CATHODE ELEMENTS

Joseph Velasquez Dec. 1968 12 p refs

(AD-680196; ECOM-3053) Avail: CFSTI CSCL 9/1

In order to understand the effects of field emission from asperities, it is necessary to make direct field-emission-current measurements of individual asperities. A procedural and evaluation technique has been refined using a modified Muller microscope with a motion resolution of 0.006 micrometers (60 A), which accurately determines the location and density of micron-sized asperities. The surface of a film of molybdenum metal containing asperities is scanned by means of a fine probe tip of positive potential with respect to the sample. The equipment is described and the technique used for locating individual asperities in order to give a field-emission contour of the metal surface is reviewed. Results on experimental samples are discussed; the criterion for the electric field strength of the asperities is discussed. Author (TAB

N69-24621# Services Electronics Research Lab., Baldock (England).

GALLIUM ARSENIDE THIN FILM PHOTOCATHODES

C. H. A. Syms *In its* SERL Tech. J., Vol. 19, No. 1 Feb. 1969 12 p refs Presented at 4th Symp. on Photoelectron-Image Devices, London, Sep. 1968 (See N69-24617 12-34)

Avail: CFSTI

The possibility of forming photocathodes from GaAs thin films deposited on transparent substrates was investigated. It was shown that GaAs layer can be deposited on polished sapphire and then cesiated to provide acceptable emission efficiencies. The deposition, etching, baking, and cesiation processes are described, and the reflected and transmitted spectral responses are graphed. Equations for the electron density, surface recombination velocity coefficients, and photocurrent are presented and solved. It is concluded that a thin film GaAs photocathode is possible, giving efficiencies of about 1 μA/lumen in transmission and 100 μA/lumen in reflection. N.E.R.

N69-24625# Army Electronics Command, Fort Monmouth, N. J.

ELECTRICAL PULSE GENERATOR WITH SUPERCONDUCTING MAGNET AND ROTARY PRIME MOVER

Richard J. Thome and Gerhart K. Gaule Nov. 1968 40 p refs
(AD-680195; ECOM-3050) Avail: CFSTI CSCL 9/3

Short steep pulses of high electrical energy are required to drive systems such as pulsed transmitters, light sources, and plasma discharges. A low impedance stationary coil will generate such pulses when the magnetic flux threading the coil undergoes large and rapid changes. The rapid change can be achieved by a flux displacer, a conductor driven at high speed past the stationary coil. The applied field is provided in the present work by a superconducting magnet in order to produce a magnetic flux of the necessary magnitude and density with small operating loss, bulk and weight. The stationary coil which is connected to the load, and the flux displacer, which need not be superconducting, were placed outside the dewar. Two series of experiments with flux displacers driven by a rotary prime mover are discussed. The first series used relatively small, isolated specimens. These experiments served to determine the effect of displacer shape, speed and conductivity on output. The second series used relatively large displacers formed by pairs of cylindrical shell segments which were electrically and mechanically connected by end plates. These experiments give information on the influence of various system parameters on the energy, and on the duration and shape of the pulses. The results are presented in dimensionless form, so that the performance of high energy systems can be predicted. The rotary prime mover may be a lightweight explosive drive or gas turbine, or, in a vehicle or aircraft, one of the propulsion engines. Author (TAB)

N69-24648# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
INVESTIGATION OF THE LOW-FREQUENCY NOISE BEHAVIOR AND SURFACE RECOMBINATION VELOCITY OF MOS STRUCTURES UNDER THE INFLUENCE OF IONIZING RADIATION
D. Braeunig and H. G. Wagemann Oct. 1968 23 p refs In GERMAN
(HMI-B-75) Avail: CFSTI

Diode dc currents and diode noise currents of p-n-junctions underneath SiO_2 layers were measured comparing the state before and after ionizing irradiation. Within a certain voltage range both quantities show significant maxima, which depend on the state of irradiation and are related to the efficiency of energy states at the Si/SiO_2-interface. Different time constants which depend on energy and surface potential may be attributed to these states concerning their noise spectrum. As well 1/f-noise as noise of other type (about 900 cps) may be obtained by variations of surface potential. The efficiency of these states for surface recombination becomes evident simultaneously. Author (NSA)

N69-24745# General Electric Co., Owensboro, Ky. Tube Dept.
KU-BAND TRIODE AND CAVITY COMBINATION CW OSCILLATOR Final Report
J. M. Connelly and J. B. Quirk Ft. Monmouth, N. J. ECOM Nov. 1968 117 p refs
(Contract DA-28-043-AMC-00061(E))
(AD-680243; ECOM-00061-F) Avail: CFSTI CSCL 9/5

Two-hundred and sixty-eight triodes of eighteen different designs were assembled for testing at Ku-Band. Ten basically different cavity designs were evaluated during this same period. The original objective of CW operation required an anode input power of four watts. Consideration of foreshortening grid-to-anode capacitance limited the anode diameter to 0.060 in. resulting in a power density of 210 watts/sq cm. It was necessary to limit the duty to 25% in order to prevent thermal runaway conditions; at 25% duty, 16 milliwatts were obtained at 16.4 GHz. Single knob tuning provided operation over a range of 400 MHz around this center frequency. A change in objectives to accomplish dual function (transmit/receive) operation required a very high cathode current density (30 A/sq cm capability) for transmit operation. Different cathode materials, primarily coated-powder carbonates, were evaluated with negative results because of inadequate emission levels. Dispenser type cathodes were also evaluated but were prone to give excessive sublimation. Highest power output in the transmit mode was 7.5 watts; highest power output in the local oscillator or function was 150 milliwatts with a useful band-width of 400 MHz. Simultaneous optimization of transmit and local oscillator functions was not feasible. Best operational life achieved under local oscillator conditions was 70 hours. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N69-23397 California Univ., Los Angeles.
RESEARCHES IN OPTIMAL AND SUBOPTIMAL CONTROL THEORY
Garfield Kang (Ph.D. Thesis) 1968 95 p
Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-14543

The notion of a regret function is introduced. This function is a measure of the performance value for an admissible control relative to an optimal control. An integral representation for the regret function is derived. The regret function and its integral representation are control theoretic equivalents to Weierstrass' formula for the total variation with respect to a minimum in the calculus of variations. Explicit approximation conditions are derived with respect to the problem of approximating optimal, linear, time-varying controls by simpler ϵ-optimal controls. Algorithms for monotone approximations to unknown optimal controls are considered. Two algorithms are studied. A criterion is given for termination of the algorithms when an ϵ-optimal control is obtained. Theorems on the monotone improvement of successive solutions are given. Dissert. Abstr.

N69-23408 George Washington Univ., Washington, D. C.
SYNTHESIS OF ACTIVE RC NETWORKS USING STATE-SPACE MODELS
Nicholas Kyriakopoulos (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-13715

A technique has been developed for the realization of a certain class of active RC networks from a given state matrix A. The networks under consideration contain an all-capacitor tree, but they do not have any all-capacitor circuits. Dependent voltage or current sources are included in the network; each voltage source is connected in series with a resistive chord, and each current source is in shunt with a capacitive branch. The controlling variables for the voltage sources are capacitive voltages, and for the current sources they are either resistive voltages or resistive currents; there is one-to-one correspondence between dependent sources and controlling variables. Dissert. Abstr.

N69-23433# Queens Univ., Kingston (Ontario). Dept. of Electrical Engineering.
CHARACTERIZATION AND OPTIMIZATION OF NONLINEAR SYSTEMS
M. Arozullah Aug. 1968 42 p refs
(Contract CD-DRB-713003; Grant NRC A-4392)
(RR-68-4) Avail: CFSTI

A method of characterization and optimization of a class of nonlinear systems for which the input and output are ergodic random processes is presented. In this method the system is

realized as a cascade combination of a single input–multi-output linear system followed by a multi-input–single output nonlinear no-memory system. The linear part of the system is such that its memory pattern can be adjusted as desired. The nonlinear no-memory part is a piecewise multilinear function of its inputs. This model is then used to optimize the system with a minimum weighted mean-square error criterion. This method of optimization is independent of the statistics of the input. A method of synthesis of the optimum system thus obtained is presented also. Author

N69-23599 Montana State Univ., Missoula.
NETWORK THEORY FOR OPTIMAL PULSE DESIGN VIA PONTRYAGIN'S MAXIMUM PRINCIPLE
Merle Edward Ross (Ph.D. Thesis) 1968 266 p
Avail: Univ. Microfilms: HC $12.15/Microfilm $3.45 Order No. 68-14359

The development of concepts and techniques of optimal input signal design for linear, lumped-element, time-invariant electrical networks is discussed. A topologically based procedure for representing networks by state variable equations is given. Energy relations are derived from the state variable equations representing the network. A generalized augmented performance criterion utilizing the network energy relations is introduced. Application of Pontryagin's maximum principle to the optimal input signal design problem leads to the conclusion that the optimal input signal is in general composed of both bang-bang and singular segments–examples are given that demonstrate the non-necessity of the sufficient conditions for a singular segment, and illustrate a technique of solving the necessary condition equations for simple networks. Dissert. Abstr.

N69-23609 Denver Univ., Colo.
OPTIMIZATION OF RANDOM SYSTEMS BY MINIMIZATION OF THE EXPECTED VALUE OF A QUADRATIC PERFORMANCE INDEX
Lloyd Benjamin Patrick (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-14043

An algorithm is given for obtaining the optimal control law in closed-loop fashion for a linear time-varying system. The control law is optimal in the sense that the expected value of the performance index is minimized. The algorithm is applied to a scalar example, the well-known second-order example problem of Rohrer and Sobral, and the design of a pitch axis controller for a high performance aircraft. The design results are compared with those of: (1) an adaptively optimal system whose control law is optimal for the existing parameter value, (2) an optimal system designed about the nominal parameter value, and (3) an optimal system in the sense of Rohrer and Sobral. Dissert. Abstr.

N69-23666 Missouri Univ., Rolla.
MULTIPORT SYNTHESIS WITH MULTILAYERED DISTRIBUTED PARAMETER RC NETWORKS
Walter Ronald Koenig (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-14046

Synthesis and design techniques for multiport, multilayered, distributed parameter RC networks are investigated. The basic building block is a network section of uniform width consisting of alternate layers of resistive and dielectric materials on top of a perfectly conducting plane. The resulting network is composed of a cascade of these sections with all access terminals at one end of the cascaded network. The terminals at the other end are either open circuited or short circuited. A method is discussed for synthesizing a network from a prescribed network admittance matrix. An approximation technique is given for obtaining a realizable network immittance matrix from Bode plots of the short circuit admittance parameters for the four-layered case. Dissert. Abstr.

N69-23777 IIT Research Inst., Chicago, Ill.
TRANSFORMER CORE SIMULATION IN FERRORESONANCE STUDIES
Glenn William Swift (Ph.D. Thesis) 1968 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-14917

This investigation is concerned with ferroresonance and subharmonics in power systems circuits having a transformer with a nonlinear iron core. The investigation is essentially in three parts: (1) determination of a sufficiently accurate model of saturation, hysteresis, and eddy current effects, under dynamic conditions; (2) application of a purely analytical method to the prediction of ferroresonance under diverse circuit conditions; and (3) an analog computer study of the effects of nonlinearity model refinements on solution accuracy. Tests on a real transformer were made to determine hysteresis loop behavior for various conditions of flux amplitude and asymmetry. Tests were made at zero frequency, using an operational amplifier for integration purposes, in order to eliminate eddy current effects. Dissert. Abstr.

N69-24485# Joint Publications Research Service, Washington, D. C.
FOURTH ALL-UNION CONFERENCE ON AUTOMATIC CONTROL
31 Mar. 1969 34 p refs Transl. into ENGLISH from Avtomat. i Telemekh. (Moscow), no. 1, 1969 p 164–183 Meeting held at Tbilisi, USSR, 30 Sep.–5 Oct. 1968
(JPRS-47747) Avail: CFSTI

The conference papers are briefly reviewed, along with the recent advances in Soviet automatic control technology. Areas of improvements include remote control, computer technology, synthesis of systems, fluidics, reliability, and simulation of scientific and engineering systems and subsystems. The most important areas for future study are listed. The papers were presented in the following sections: optimum systems, adaptive systems, pattern recognition, statistical methods in automatic control theory, identification of control objects, nonlinear control systems, multiple-connected systems, systems with variable structure and discrete systems, relay devices and finite automata, new elements and devices, reliability and technical diagnostics, automatic measurements and monitoring, hybrid and control computers, and control of atmospheric reentry, spacecraft orientation, synthesized spacecraft, earth satellite stabilization, and rendezvous. N.E.N.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N69-23428# Los Alamos Scientific Lab., N. Mex.
ON THE MEDIUM-ENERGY PHYSICS PROGRAM Quarterly Status Report, Period Ending 31 Oct. 1968
10 Dec. 1968 51 p refs
(Contract W-7405-ENG-36)
(LA-4053-MS) Avail: CFSTI

Operation of the Electron Prototype Accelerator is described, and design studies and prototype development for the Los Alamos Meson Physics Facility are outlined. RF power systems, accelerator

control and instrumentation, accelerator physics, the experimental area, LAMPF scheduling and facility construction, and physics research are discussed. NSA

N69-23439*# Rice Univ., Houston, Tex.
A GROWTH/CHANGE STRATEGY FOR PLANNING SPACE SCIENCE LABORATORY FACILITIES
James Y. Robinson, Jr. (M.S. Thesis) Aug. 1968 162 p refs
(Grant NGR-44-006-033)
(NASA-CR-100691) Avail: CFSTI CSCL 14B

A principle is proposed, based on an exploration of general methods, that growth is dependent upon a system of different types of cells, mixed together proportionally, with limits of flexibility established for any or all of the proportions. In order to determine these cells, functional areas of the laboratory environment are ascertained by analysis of existing laboratories and inventory of specific resources. A computer program is described which was developed to determine the proportions of these functional areas to each other. The porportions provided by the computer are analyzed to calculate the limits of variation for each proportional relationship. The growth principle and its determinants are then tested by a simulated application, a demonstration of a design for a space science laboratory system. P.A.B.

N69-23686*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
FEASIBILITY STUDY OF EXPERIMENTAL METHODS FOR JOINT DAMPING ANALYSIS
E. J. Rodgers, B. D. Liaw, and R. G. Sturm Aug. 1968 36 p refs
(Contract NASB-20073)
(NASA-CR-98385; AST-278) Avail: CFSTI CSCL 14B

Results for the experimental feasibility investigation of a damping test apparatus using a structural bolted joint are presented. Experimental data as well as the test setup and the overall recording arrangement are described. The results obtained seem adequate for answering some important questions set forth before the test program. Recommendations for improvements in the equipment and the procedures for future test programs are indicated and discussed. Author

N69-23710# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
TWO-FLASH THRESHOLDS AS A FUNCTION OF FLASH LUMINANCE AND AREA
Mark F. Lewis Sep. 1968 10 p refs
(AM-68-20) Avail: CFSTI

The recent use of strobe lights in aviation suggests the possibility of using temporal patterns of short duration flashes as information-carrying signals. Under night flight conditions, two-flash thresholds were obtained using a two-interval, temporal forced-choice technique with foveally fixated circular targets varying in luminance and area. For all subjects the results replicated a previous finding that two-flash thresholds are a negatively accelerated function of flash luminance, but the function was shown to be dependent on area, a greater threshold change occurring at smaller areas. Two-flash thresholds were also found to be a decreasing function of stimulus area, with the greatest threshold change occurring at low luminances. Author

N69-23816# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ELECTRONIC DESIGN AND CONSTRUCTION OF A NOBLE GAS ATMOSPHERIC TRACER SYSTEM
J. J. Leshock *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 54–57 ref (See N69-23812 12-13)
Avail: CFSTI

An electronic system combining much available commercial equipment along with transistor and integrated circuit components specially designed to continuously collect and store data from at least 63 field-located radiation detectors has been developed and built. Atmospheric beta activity introduced by means of a radioactive noble gas tracer, ^{85}Kr, is monitored by 63 Geiger counters. The resultant signals enter preamplifiers specially designed to facilitate, through a long cable of up to 1600 meters, transmission to a central data sorting and accumulation and readout center. Author (NSA)

N69-23817# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
AUTOMATIC REAL-TIME AIR MONITORING OF Kr-85 UTILIZING THE 4096 MEMORY OF A MULTIPARAMETER ANALYZER
J. D. Ludwick, J. J. Leshock, R. F. Connally, and P. W. Nickola *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 58–62 refs (See N69-23812 12-13)
Submitted for publication
(BNWL-SA-1555) Avail: CFSTI

A noble gas atmospheric monitoring field grid system in which ^{85}Kr is used as a tracer has been designed, assembled and used for studying atmospheric transport and diffusion. This system has demonstrated its usefulness in the quantitative measurement of the transport and diffusion of both continuous and true puff-type radioactive gas releases on a real-time basis. Small fluctuations in the air concentrations of the tracer are determined by using electronic instrumental data collection times as short as one second. The system consists of a large group of field detectors which relay their information to a 4096 address memory. The memory is programmed to accept information from 64 detectors. Information is accumulated in groups of 64 time channels and these groups are automatically stepped by the programmer. A time interval selector can be set to automatically regulate the stepping process at a slow or fast rate in effecting the desired differential data accumulation. The memory is read out on magnetic tape and the equipment is ready for the next field test 35 sec after completion of the first. Author (NSA)

N69-23824# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
WIND TUNNEL FOR PARTICLE DEPOSITION MEASUREMENTS
G. A. Sehmel, L. C. Schwendiman, and T. W. Horst *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 101–103 refs (See N69-23812 12-13)
Avail: CFSTI

A wind tunnel was designed and installed for measuring particle deposition onto surfaces. The tunnel has a 2×2 ft cross section, with a test section 30 ft long. Author (NSA)

N69-23836# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
A PORTABLE LABORATORY
H. G. Rieck and N. A. Wogman *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 190–194 refs (See N69-23812 12-13)
Avail: CFSTI

The design and operation of a portable laboratory for remote site use in atmospheric physics, fallout, and other studies are described. The laboratory consists of an air-conditioned truck-type trailer which is outfitted with facilities for sampling, for sample processing in a chemical laboratory area, and for measuring radioactivity in a counting room. NSA

N69-23870# Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.
VAN de GRAAFF LABORATORY Progress Report
T. P. David, comp. 1968 77 p refs
(BARC-364) Avail: CFSTI

Experiments on charged particle induced reactions, particle gamma angular correlation, and fast neutron induced fission are summarized. A modification in the air conditioning system which markedly reduces the relative humidity and improves the accelerator performance is also reported. Author

N69-23928*# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
ADVANCED REFRACTORY ALLOY CORROSION LOOP PROGRAM Quarterly Progress Report, 15 Oct. 1968–15 Jan. 1969
R. W. Harrison 9 Apr. 1969 30 p refs
(Contract NAS3-6474)
(NASA-CR-72527; GESP-196; QPR-15) Avail: CFSTI CSCL 14B

The reinstrumentation, reinsulation of the T-111 corrosion loop, and the sealing of the vacuum chamber are described. Details of the lithium purification and analysis are tabulated. Comparison data of the mutual solubilities of potassium and lithium are presented in tables. Flushing and charging of the loop by alkali metal is reported. F.O.S.

N69-24060# California Univ., Berkeley. Lawrence Radiation Lab.
THE ELECTRON-RING ACCELERATOR PROGRAM AT LRL
R. W. Allison, Jr., R. T. Avery, W. R. Baker et al 1 Oct. 1968 14 p refs Presented at USSR Natl. Particle Accelerator Conf., Moscow, 9–16 Oct. 1968 Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-18498; Conf-681029-1) Avail: CFSTI

A progress report is presented on the activities at LRL in connection with electron-ring accelerators. A two-stage compressor unit (employing only low-intensity beams) has been built, and operated with a 4-MeV 100-mA linac as an injector. Electron rings have been formed and compressed from 20 cm radius to 7 cm radius. A three-stage compression unit has been constructed and is now under test with the high intensity (200 A) 3.3-MeV beam of the Astron injector. The apparatus is described. Design work on a magnetic expansion unit is reported. Author (NSA)

N69-24071# Signals Research and Development Establishment, Christchurch (England).
THE BUMP TESTING OF MILITARY SIGNALS EQUIPMENT IN THE UNITED KINGDOM
W. Childs Sep. 1968 8 p Presented at the 39th Shock and Vibration Symp., Monterey, Calif., 22–24 Oct. 1968 Sponsored by Shock and Vibration Inform. Center and NRL
(SRDE-68021) Avail: CFSTI

The paper explains the need for mechanical proofing tests on equipments, sub-assemblies and components and briefly describes the first bump test machine built to carry out such tests, and the machine's shortcomings. The characteristics of the current British bump test and the reasons for its form are dealt with, leading to the design and manufacture of the 50lb and 250lb machines currently used in the U.K. capable of applying the test. The design, operation and performance testing of these machines is dealt with in some detail. Author (ESRO)

N69-24078# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DESIGN OF FFTF CLOSED LOOPS
M. A. Vogel 31 Oct. 1968 9 p Presented at Conf. on Sodium Technol. and Large Fast Reactor Design, Argonne, Ill.
(Contract AT(45-1)-1830)
(BNWL-SA-2190; Conf-681106-10) Avail: CFSTI

Design aspects of the sodium-cooled closed loops for the Fast Flux Test Facility are described. The loop primary system and in-reactor tube designs are illustrated, and the loop testing capabilities and proposed solutions to some of the major design problems are tabulated. NSA

N69-24089*# Michigan Univ., Ann Arbor.
MAGNETIC FIELD PROPERTIES RELATED TO THE DESIGN OF A ONE-COMPONENT MAGNETIC SUPPORT-AND-BALANCE SYSTEM
K. R. Sivier Washington NASA May 1969 50 p refs
(Grant NGR-23-005-003)
(NASA-CR-1352) Avail: CFSTI CSCL 14B

Calculations have been made of the magnetic performance characteristics of air-cored solenoids applied to a one-component magnetic support-and-balance system. These characteristics include field strength, field gradients, static stability derivatives for a ferromagnetic body in the solenoid field, and the solenoid power required to produce given field strengths and to levitate a magnetic body. These characteristics were calculated only in the vicinity of the solenoid axis and are shown to be related simply to four fundamental, shape dependent, dimensionless parameters (and to several ratios of these parameters). Author

N69-24102# Massachusetts Inst. of Tech., Cambridge.
DESCRIPTION OF SOME ACCELERATOR FACILITIES
In its Medium Energy Nuclear Phys. with Electron Linear Accelerators 1967 p 15–90 refs (See N69-24101 12-24)
Avail: CFSTI

The design objectives of the LNS-MIT 400 and the Saclay electron linear accelerators are discussed and the characteristics of their electron beam are compared with those of older facilities. G.G

N69-24122# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FAST FLUX TEST FACILITY CLOSED LOOP DEVELOPMENT AND TESTING PROGRAM
R. Kolowith Nov. 1968 65 p refs
(Contract AT(45-1)-1830)
(BNWL-852) Avail: CFSTI

Topics discussed concerning the closed loop system test installation include: verification of analytical design; investigation of FTR performance parameters and limited transient effects; demonstration of remote handling and maintenance equipment; testing of closed loop system components; and training of operators and maintenance personnel. NSA

N69-24134# Royal Aircraft Establishment, Farnborough (England).
BILATERAL ELECTROMECHANICAL TRANSDUCERS: A UNIFIED THEORY
H. K. P. Neubert Oct. 1968 41 p refs
(RAE-TR-68248) Copyright Avail: CFSTI

This report offers a unified treatment of bilateral electromechanical transducers in terms of simple matrix algebra applied to the general theory of linear two-ports with mechanical and electrical elements. Based on earlier work related to electroacoustic transducers, it derives the general transfer matrix equations applicable to voltage-source and current-source type

electromechanical transducers and investigates the specific, and common, properties of electrodynamic, piezoelectric, electrostatic and electromagnetic receivers and senders with particular reference to their frequency response characteristics. Author (ESRO)

N69-24148# Oak Ridge National Lab., Tenn.
THE INTERMEDIATE POTASSIUM SYSTEM: A RANKINE-CYCLE TEST FACILITY
M. M. Yarosh and P. A. Gnadt Oct. 1968 177 p refs
(Contract W-7405-ENG-26)
(ORNL-4025) Avail: CFSTI

A comprehensive description of the design, operation, and analysis of a single loop, boiling K, Rankine cycle system is presented. The system is designed to be a 36% power mock-up of the Medium Power Reactor Experiment, with electrically heated rods used to simulate the fuel elements of the reactor. A K-vapor turbine driving a centrifugal pump provides the feed to the boiler, and a valve is used as an adjustable orifice to simulate the turbine of a turbine-generator. The vapor is condensed in a tapered tube space-type radiator from which the heat is transmitted by thermal radiation to the inner wall of a double-walled compartment. Air is circulated between the walls. The stability and control characteristics of the system are investigated over a power range from zero to 335 kW. Author (NSA)

N69-24201# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FAILURE OF CENTRIFUGAL AIR COMPRESSOR UNIT NO. 2, WIND TUNNELS, ABERDEEN PROVING GROUND, MARYLAND
E. F. Reklis Nov. 1968 53 p refs
(AD-682727; BRL-TN-1707) Avail: CFSTI CSCL 14/2

Background and descriptive information is given of a centrifugal air compressor failure which occurred at the Wind Tunnels Facility, Aberdeen Proving Ground, Maryland, on 25 January 1968. An impeller wheel burst and pieces of the wheel broke through the casing of the machine. Author (TAB)

N69-24249# Royal Aircraft Establishment, Farnborough (England).
THE APPLICATION OF CORRELATION TECHNIQUES TO GROUND BASED AIDS IN THE TERMINAL AREA
J. Benjamin *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 1 p (See N69-24230 12-02)
Avail: CFSTI

Research aimed principally at improving the performance of an instrument landing system (ILS) and investigating its role in future terminal area operations is studied. It is stated that true compatibility can be designed for without introducing undesirable restrictions or degrading performance. The present status of ILS, the way in which medium and long term objectives may be achieved using hyperbolic phase fields and correlation detection, the features of the new ILS affecting the pilot, and methods for easing problems associated with pilot monitoring are reviewed. P.A.B.

N69-24282# Columbia Univ., Dobbs Ferry, N. Y. Hudson Labs.
A CYLINDRICAL PARABOLIC REFLECTOR FOR USE WITH PIEZOELECTRIC CYLINDRICAL TRANSDUCERS, AS APPLIED TO LATERAL ECHO UNDERWATER SURVEY
F. W. Cole Jan. 1968 32 p refs
(Contract Nonr-266(84))
(AD-680244; CU-182-66-ONR-266-Phys; TR-154) Avail: CFSTI CSCL 20/1

A parabolic lead reflector designed for creating a narrow sound beam at an underwater frequency of 30.5 kHz from an array of cylindrical ceramic piezoelectric crystals is described. The reflector consists of sheet lead 1/4-in. thick, backed by an aluminum stiffener sheet, 1/8-in. thick. Brackets for supporting the cylindrical crystal assembly are positioned at three points along the focal axis of the reflector. Clamping brackets for holding the cylindrical transducer are used to secure the transducer to the mounting brackets along the reflector axis. The cylindrical transducer assembly consists of 18 ceramic, lead zirconate cylinders, 1-1/2 in. O.D. and 2-1/2 in. long. The cylinders are cemented end to end to form a single, long, cylinder transducer. The oil reservoir maintains pressure balance in the transducer as the transducer is raised or lowered or varies in depth during submerged towing. Author (TAB)

N69-24283# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
GLOVEBOXES LINED WITH TEFLON
Robert L. Dainay 7 Feb. 1969 7 p
(Contract AT(29-1)-1106)
(RFP-823) Avail: CFSTI

Gloveboxes fabricated from carbon steel and lined with Teflon fluorocarbon resin produce a corrosion-free enclosure for the analysis of ultra-pure plutonium. The steel glovebox provides the enclosure for handling plutonium and prevents radioactive materials from escaping into the laboratory. The interior surface of the box is a sheet of Teflon cemented to the steel. Glovebox hardware and accessories are fabricated from Teflon or Kel-F resins, or metal coated with a Kel-F dispersion. A stainless steel glovebox was lined with Teflon to verify results of coupon tests. This test glovebox was then used daily to evaluate the practicability of using gloveboxes lined with Teflon for laboratory operations. Some metal surfaces were left exposed so that stainless steel and surfaces lined with Teflon could be compared in the same atmosphere under laboratory usage. Author (NSA)

N69-24321*# American Optical Co., Southbridge, Mass.
PNEUMATIC MIRROR SUPPORT SYSTEM
Kenneth L. Kemp, inventor (to NASA) Issued 11 Feb. 1969 (filed 24 Aug. 1965) 7 p Cl. 350-310
(Contract NAS1-2593)
(NASA-Case-XLA-3271; US-Patent-3,427,097; US-Patent-Appl-SN-482313) Avail: US Patent Office

A mounting arrangement for a telescope mirror features pneumatic supports distributed about the rear and the circumference of the mirror together with a control system which varies the pressure in both sets of supports as a function of the elevation angle of the telescope. Official Gazette of the U.S. Patent Office

N69-24356*# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
ADVANCED REFRACTORY ALLOY CORROSION LOOP PROGRAM Quarterly Progress Report, 15 Jul.-15 Oct. 1968
R. W. Harrison 20 Mar. 1969 76 p refs
(Contract NAS3-6474)
(NASA-CR-72505; GESP-189; QPR-14) Avail: CFSTI CSCL 14B

Evaluation of the boiler material documented it for reuse and the boiler was subsequently repaired and postweld annealed. A special welding chamber was installed on the T-111 corrosion loop facility and qualified for welding. The repaired boiler was reinstalled in the loop and postweld annealed. The loop is ready for reinstrumentation. Testing of three ASTAR alloy lithium thermal convection capsules was initiated. Author

N69-24499# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
NONDESTRUCTIVE TESTING OF ISOTOPE CONTAINMENT CAPSULES: REMOTE ULTRASONIC TEST STATION UT-40
R. W. Steffens and F. M. Coffman Nov. 1968 41 p refs
(Contract AT(45-1)-1830)
(BNWL-918) Avail: CFSTI

The tester consists of two parts: an ultrasonic test tank which is placed in the hot cell, and an electronic console which is placed outside the cell. The test tank provides for rotation of the capsule; axial translation of the ultrasonic transducer; devices to monitor the location of the incident ultrasonic beam on the capsule; and provisions for circulating cooling water. The electronic console provides motor controls for the test tank; electrical power for ultrasonic-beam position monitoring devices; broadband excitation for the ultrasonic transducer and amplification of the resulting signals; analog synthesis of the ultrasonic signals; and recording of defect signals as a function of circumferential and axial defect position on the capsule. An oscilloscope is used with the test station for equipment calibration and monitoring test waveforms. The ultrasonic test tank will readily facilitate right cylinder capsules other than the SNAP-21 capsules, by replacing the SNAP-21 collar with a collar of the proper diameter. Author (NSA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N69-23354# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TWO MODEL PROBLEMS ON AGGRESSIVE FLUID MOTION IN POROUS MEDIA
V. I. Penkovskii [1968] 3 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekhn. Fiz. (USSR), no. 6, 1968 p 155–158
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

In fluid filtration through a porous medium cases are possible when the filtering fluid enters into reaction with the material of the medium with the result that the pore space changes. Problems of incompressible fluid motion in a circular tube (capillary) or slot, and reacting with the walls can be the models for this process. Author

N69-23359 City Univ. of New York.
HEAT CONDUCTION WITH MELTING OR FREEZING IN A CORNER
Kenneth Albert Rathjen (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-15949

The thesis presents analytical and finite difference solutions to the two dimensional free boundary problem of solidification of a liquid, initially at a uniform temperature and filling the quarter space $x, y > 0$, subject to a constant wall temperature. The problem is the two dimensional analog of Neumann's freezing problem. Melting is shown to be mathematically equivalent to freezing. The chemical and magnetic diffusion analogs are given. Similarity is shown to exist, and the number of independent variables is thereby reduced from three to two, with the moving interface being mapped into a stationary one. Superhyperbolas of the form to represent the interface position are established, by extending to the two dimensional domain, Lightfoot's moving source approach without the restrictive assumption of equal thermal conductivities and specific heats in the liquid and solid regions. Dissert. Abstr.

N69-23377 Utah Univ., Salt Lake City.
THE TRANSPIRED TURBULENT BOUNDARY LAYER WITH HEAT TRANSFER
Sadiq Jaafar Alsaji (Ph.D. Thesis) 1968 376 p
Avail: Univ. Microfilms: HC $17.10/Microfilm $4.80 Order No. 68-14054

The purpose of this thesis was to study the effects of transpiration and heat transfer upon a turbulent boundary layer on a flat plate. Particular attention was devoted to development of a mathematical model and obtaining an approximate analytical solution for the Spalding function, and development of a universal temperature inner law. Experimental results were compared with the approximate solution and indicated that the model can be used to predict the Spalding function for different transpiration rates quite accurately. Dissert. Abstr.

N69-23378 Michigan Univ., Ann Arbor.
NUMERICAL ANALYSIS OF THE LAMINAR BOUNDARY LAYER EQUATIONS FOR FLOW OVER YAWED WINGS
K. Kamalaka Rao (Ph.D. Thesis) 1968 200 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-13385

The object of this work is to present a numerical method of solving the laminar boundary layer equation for flow over infinite aspect ratio yawed wings and to illustrate the method with examples. Incompressible and compressible cases are solved separately because of their nature. In the incompressible flow case the problem consists of solving two momentum equations; the first independent of the second equation but not vice versa. The first momentum equation is solved by means of an extension of the Hartree-Womersley method and the results are used in solving the second. Gortler's transformation is used to transform the boundary layer equations into a more suitable form for numerical work. The input to the computer program is the freestream velocity distribution in terms of the space coordinates. The method is illustrated by solving the equations for four different freestream velocity distributions. Dissert. Abstr.

N69-23380 Arizona Univ., Tucson.
THE TRANSITION FROM THE TURBULENT TO THE LAMINAR REGIME FOR INTERNAL CONVECTIVE FLOW WITH LARGE PROPERTY VARIATIONS
Carlos Weldon Coon, Jr. (Ph.D. Thesis) 1968 200 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-13679

The results of a primarily experimental study of the transition from turbulent flow to laminar flow as a consequence of high heating rates are presented. Results are reported for hydrodynamically fully developed, low Mach number flows of air and helium through a vertical, electrically heated, circular tube at entering Reynolds numbers from 1700 to 40,000 and wall-to-bulk temperature ratios to 4.4. Dissert. Abstr.

N69-23403 Alabama Univ., University.
HYPERSONIC LAMINAR BOUNDARY LAYERS AROUND SLENDER BODIES
Rao V. S. Yalamanchili (Ph.D. Thesis) 1968 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-15520

The compressible laminar boundary layer equations are considered for hypersonic flow around a slender body. The most important interaction (i.e., the boundary layer-inviscid interaction) is taken into account. The tangent wedge formula for two dimensional bodies is used for the external pressure distribution. The boundary layer equations and the boundary conditions are transformed into a familiar form by using some features of the transformations of Howarth, Dorodnitsyn, Stewartson, and Mangler. A linear

viscosity-temperature law and Newtonian fluid approximations are introduced. The formulation of the problem is general and is applicable for both two dimensional and axisymmetric slender bodies. The assumption of a Prandtl number of unity and of an isothermal body are not mandatory but are invoked here to make the governing equations more tractable. Dissert. Abstr.

N69-23410 Rutgers Univ., New Brunswick, N. J.
SOME PROBLEMS IN A TURBULENT GAS-SOLID SUSPENSION FLOW
Phileman Shu-Huan Baw (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-14239

Following the Reynolds averaging method of turbulent analysis and Pai's approach to the problem of turbulent flow in a circular pipe, the solid-phase density distribution in gas–solid turbulent pipe flow is found to be controlled by the correlation of axial and transverse particle velocity. Sample measurements of the solid-phase density profile were obtained by toptical techniques. An analysis of the apparent particle energy spectrum function was undertaken in addition to the analysis of the effect of particles on the fluid energy spectrum. In universal equilibrium range, the energy spectrum function, E(k), which is obtained by using Pao's hypothesis, decreases at a higher rate than for the case of pure air as k increases. Dissert. Abstr.

N69-23448# Aeronautical Research Inst. of Sweden, Stockholm.
ON VISCOUS WEDGE-FLOW
Inge L. Ryhming Oct. 1968 25 p refs
(FFA-116) Avail: CFSTI

Laminar incompressible flow past a wedge is studied by employing optimal coordinates in the full Navier–Stokes equations. The resulting boundary value problem is solved approximately by an iterative method for large distances away from the wedge tip. Attempts to analyse the flow close to the wedge tip are also included. Eigenvalues and eigenfunctions for Stokes flow are given in the optimal coordinates. A perturbation procedure for large wedge-angles is considered leading to an approximate local solution. Author

N69-23467*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE LEADING-EDGE EFFECTS ON THE LAMINAR FLATPLATE BOUNDARY LAYER AND THE AERODYNAMIC HEATING AT MACH 10.4
Howard W. Stone Washington May 1969 34 p refs
(NASA-TN-D-5160) Avail: CFSTI CSCL 20D

Wall pressure and heat transfer distributions and boundary layer impact pressure profiles were obtained on a flat plate with both sharp and cylindrically blunted leading edges. The range of free stream Reynolds number based on leading edge thickness was from 73 to 70,000. Although the boundary layer displacement effects behind a sharp leading edge are known to increase the wall pressure and heat transfer in the weak interaction regime, these tests show that boundary layer displacement effects result in only a slight change in the impact pressure and velocity profiles. Slight blunting of the leading edge had little effect on the pressure distribution but, with the boundary layer growing in an entropy gradient, the heat transfer was reduced. Large leading edge bluntness increased the heat transfer relative to the sharp leading edge. Author

N69-23476 Oregon State Univ., Corvallis.
ON THE NUMERICAL SOLUTIONS OF THE GENERAL NAVIER-STOKES EQUATIONS FOR TWO-LAYERED STRATIFIED FLOWS
John Dzen Hwang (Ph.D. Thesis) 1968 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-14480

The objective of this paper is to seek the general solution of the complete Navier-Stokes equations governing heterogeneous, time-dependent, incompressible, viscous, laminar fluid dynamics through digital simulation. In particular, two-layered stratified flows are treated by using a numerical algorithm called the Marker-and-Cell extended method (MACE), which is an extension of the MAC code. The finite-difference scheme of MACE algorithm is discussed in detail, and specific boundary conditions are derived for the MACE code allowing inflow and outflow capabilities, no-slip and free-slip boundary-layer considerations, and free-surface formulation. An example involving two-layered stratified fluid flow with inflow and outflow is presented. A complete set of flow diagrams demonstrating the logical sequence of calculations by the MACE method is provided; a FORTRAN IV program listing is appended. Dissert. Abstr.

N69-23499 Stanford Univ., Calif.
AN EXPERIMENTAL STUDY OF TURBULENCE PRODUCTION NEAR A SMOOTH WALL IN A TURBULENT BOUNDARY LAYER WITH ZERO PRESSURE-GRADIENT
Heung-Tae Kim (Ph.D. Thesis) 1968 182 p
Avail: Univ. Microfilms: HC $8.10/Microfilm $3.00 Order No. 68-15065

Detailed study of the structure of a turbulent boundary layer near a smooth wall is presented including instantaneous values of: velocity profiles, fluctuation data, and turbulence production rates. It is shown that essentially all the turbulence production occurs during bursting times. The details of the bursting process are described in three stages: low-speed streak lifting, oscillatory growth, and breakup. It is shown that the streak-lifting creates an unstable (inflexional) region in the instantaneous velocity profile. This unstable region is followed, in the downstream flow, by oscillatory growth and breakup. Data suggest that the process of turbulence production near smooth walls is due to the formation of a local instability of the Kelvin-Helmholtz type arising from the interaction of the wall model with the outer flow, that is from low-speed streak lifting. Dissert. Abstr.

N69-23566 Colorado Univ., Boulder.
MAGNETOHYDRODYNAMIC FLOW PAST AXISYMMETRIC BODIES
Kanwal Jit Parbhakar (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-14226

The steady, axially symmetric flow of an inviscid, incompressible, conducting fluid, in the presence of an aligned magnetic field, past fixed bodies, semi-infinite and closed, is considered as a problem of finite perturbation. The conductivity is assumed to be small so that the external magnetic field is not perturbed by the motion: at the same time the external field is assumed very strong so that when coupled with the small induced current it modifies the motion appreciably. This problem involves the solution of a boundary value problem with an elliptic partial differential equation. The solution indicates the presence of a nondiffuse boundary layer and wake for the semi-infinite body and the closed body respectively. The effect of the body is felt upstream and is carried downstream in the form of a nondiffusive boundary layer or wake. This solution is used to calculate the drag, the boundary layer thickness, the displacement thickness, the momentum thickness and the wake width. Dissert. Abstr.

N69-23611 Alabama Univ., University.
A STUDY OF VISCOUS EFFECTS IN SEPARATED COMPRESSIBLE FLOW

Santiago D. Ximenez (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-15519

In this dissertation a set of nonlinear differential equations for the separated flow is developed and a method of solution is presented. In the present analysis the magnitude of the angles relative to the flow are considered significant and, therefore, the trigonometric functions have not been linearized. This permits the application of these equations to several flow configurations where the angles are definitely appreciable, such as the turbulent flow over a rearward facing step. The initial conditions to the set of equations are characterized by the parameters of the boundary layer upstream of the separated flow. In order to obtain the values of these parameters a study is made of both laminar and turbulent compressible boundary layers. For turbulent flow, in particular, a technique is developed to evaluate the velocity profiles. This technique gives results that correlate very closely with the available experimental data. Dissert. Abstr.

N69-23636 Arizona Univ., Tucson.
A FREE BOUNDARY PROBLEM FOR THE FLOW OF A HEAVY LIQUID THROUGH AN UNOBSTRUCTED ORIFICE
Andrew Grossfield (Ph.D. Thesis) 1968 58 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-14508

An inviscid incompressible liquid, flowing steadily and irrotationally in two dimensions, discharges from between two horizontal, impermeable walls with gravity acting vertically downward. The lower wall is infinite in both directions, while the upper one extends infinitely only upstream. The remaining part of the upper boundary is a free streamline, that is, the pressure on it is constant. The far upstream and far downstream velocities are considered uniform. The problem under consideration is to find the free streamline. The method of solution is described. The pressure condition on the free streamline leads to a nonlinear integral equation. The solution of this equation enables the free streamline and the velocity on it to be computed. Dissert. Abstr.

N69-23648 Texas Univ., Austin.
PRESSURE DROP IN TWO-PHASE ANNULAR GAS-LIQUID FLOW
James David Lowther (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-16113

Pressure drop is predicted for adiabatic, two phase, annular, gas-liquid flow inside horizontal pipes. The analysis includes the effects of friction and acceleration on pressure drop. The annular flow is modeled as a nonhomogeneous mixture of liquid and gas whose density varies continuously in the radial direction. The well known mixing length theory used in turbulent single phase flow is extended to two phase flow by considering a turbulent fluctuating density component as well as turbulent fluctuating velocity components. The governing equations are solved numerically to produce a friction factor and an acceleration factor which are functions of the independent flow variables. The value of the mixing length constant used in the expression for the fluctuating density component is determined from experimental pressure drop data. Dissert. Abstr.

N69-23649 Rochester Univ., N. Y.
AN ANALYTICAL INVESTIGATION OF THE STABILITY OF HAGEN-POISEUILLE FLOW SUBJECTED TO THREE-DIMENSIONAL INFINITESIMAL DISTURBANCES
Ting-Yung Liu (Ph.D. Thesis) 1968 169 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-15844

Two methods, both analytical and numerical, are used to solve the linearized three dimensional perturbation equations. The analytical method is a successive approximation method. The direct numerical integration method starts with Frobenius solutions obtained near the center of the tube and integrates the complete three-dimensional perturbation equations to the boundary. It is found that infinite numbers of eigenmode exist for amplitude functions of disturbances. The disturbances separate themselves into two families, one propagating at a speed close to the maximum steady state velocity and the other close to zero. It is concluded that the steady, fully developed Hagen-Poiseuille flow is stable when subjected to small three dimensional disturbances. The least stable disturbance is the first mode of azimuthally periodic disturbance, which is also less stable than the rotationally symmetric disturbance. Dissert. Abstr.

N69-23667# Joint Publications Research Service, Washington, D. C.
STUDIES OF WAVE MOTIONS
8 Apr. 1969 38 p refs Transl. into ENGLISH of the Book "Sovrenevyye Voprosy Gidrodinamiki" Kiev, Naukova Dumka, 1967 p 249–266; 291–299
(JPRS-47807) Avail: CFSTI

CONTENTS:

1. UNSTEADY WAVE MOTIONS OF LIQUIDS L. V. Cherkesov p 1–25 refs (See N69-23668 12-12)
2. BODY WAVE DRAG FROM INTERNAL WAVES R. B. Nudelman p 26–37 refs (See N69-23669 12-12)

N69-23668# Joint Publications Research Service, Washington, D. C.
UNSTEADY WAVE MOTIONS OF LIQUIDS
L. V. Cherkesov *In its* Studies of Wave Motions 8 Apr. 1969 p 1–25 refs (See N69-23667 12-12)
Avail: CFSTI

Processes of wave development in homogeneous, nonhomogeneous, and viscous liquids are mathematically studied. Waves which arise under the influence of two pressure systems applied to the free surface along fixed walls at right angles to one another are considered for the case of homogeneous liquids. For nonhomogeneous liquids, the problem of wave development under the influence of a periodic moving pressure system applied to the free surface of a two layer liquid, the lower layer of which has an infinite depth, is investigated. Viscous liquids are examined with regard to waves which arise on the surface of a liquid under the influence of an arbitrary initial free surface rise and from an arbitrary pressure pulse applied to the liquid surface. P.A.B.

N69-23669# Joint Publications Research Service, Washington, D. C.
BODY WAVE DRAG FROM INTERNAL WAVES
R. B. Nudelman *In its* Studies of Wave Motions 8 Apr. 1969 p 26–37 refs (See N69-23667 12-12)
Avail: CFSTI

A flow with given lower and upper liquid streams is considered, in which the free surface and interface are horizontal prior to the introduction of a disturbance. It is stated that, in the solution of the two dimensional problem, the liquid disturbance is caused by a moving singularity, a vortex-source combination, and, in the solution of the three dimensional problem, the disturbance is caused by a source. For the former case, a steady motion is obtained by superimposing on the motion of the singularity two uniform streams moving in the direction of the negative axis. In the three dimensional case, the problem of the source motion reduces to determining two harmonic functions satisfying certain boundary

conditions. A solution for the problem of vortex-source motion in the two layer liquid is presented. Rectilinear uniform motion of a wing of infinite span of any arbitrary profile is considered, and integral equations for the problem are given. It is shown that the problem of source motion reduces to the solution of the Laplace equation for the boundary conditions. The motion of a body of arbitrary form in a two layer liquid is calculated, and the problem of ellipsoid motion discussed. Limiting cases are also mentioned. P.A.B.

N69-23703 Rochester Univ., N. Y.
HYDRODYNAMIC INSTABILITY OF A THREE DIMENSIONAL TURBULENT SHEAR LAYER
Ganesh Lal Harpavat (Ph.D. Thesis) 1968 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-15836

The instability of a three dimensional turbulent shear layer is investigated for an incompressible fluid with respect to three dimensional disturbances. The mean equations of motion for a turbulent fluid are derived using a variable eddy viscosity. A suitable form of the eddy viscosity has been assumed consistent with the Mixing Length Theory and the mean velocity data available on turbulent half-jets. The stability equation is derived by introducing three dimensional wavy disturbances in the flow. The problem of the instability of the incompressible shear layer to small disturbances leads to an eigenvalue problem, with given boundary conditions at infinity. The solutions are exponential in character at the infinite boundaries. The eigenvalue problem is solved by obtaining a relation between the disturbance wave number, the Reynolds number, the phase velocity of the disturbance, and a constant parameter based on the temporal growth of the small disturbance. A direct numerical integration is performed using two numerical schemes. Dissert. Abstr.

N69-23725 Arizona Univ., Tucson.
BOUNDARY LAYERS IN MAGNETOGASDYNAMICS WITH PRESSURE GRADIENT AND HEAT TRANSFER
Francis Edward Spring, Jr. (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-14517

General equations are obtained to describe the laminar supersonic flow of slightly-ionized argon gas over a highly-cooled flat plate in the presence of a transverse magnetic field. There is no applied electric field. Magnetic effects are present in both the viscous boundary layer and the inviscid region. The fluid is assumed to be a continuum, and the fluid properties are variable. Numerical results are obtained by a finite-difference digital computer program. An experimental analysis was also performed, using the flow of slightly-ionized argon through a rectangular duct at supersonic velocities. Boundary layers on the duct walls influenced each other only at the corners. Pressure and temperature readings were used to obtain boundary layer growth and heat transfer rates. It was found, both theoretically and experimentally, that the boundary layer thickness is decreased somewhat by the application of the magnetic field. The heat transfer rate from the fluid to the plate is increased by the field. Dissert. Abstr.

N69-23764# Bureau of Mines, Pittsburgh, Pa. Explosives Research Center.
SOME ASPECTS OF THE AERODYNAMICS OF FORMATION OF FLOAT COAL DUST CLOUDS
Joseph M. Singer, N. B. Greninger, and J. Grumer Apr. 1969 28 p refs
(BM-RI-7252) Avail: Issuing Activity

The threshold of dispersal of monolayers and piles of rock dust, anthracite, and Pittsburgh seam coal dust was investigated in a small wind tunnel that simulated a coal mine gallery, with the objective of preventing or limiting the formation of flammable dust clouds. The effect of selected variables on entrainment velocity was examined. Mode of entrainment and flow processes in the wake region of dust configurations were investigated by means of high-speed motion pictures. Significant results were as follows: (1) Local minimum air velocities required for dispersal were only slightly higher for shallow dust ridges than for dust particles. (2) Minimum velocities for entrainment of dust particles from smooth glass and coal surfaces increased in the order rock dust, anthracite, Pittsburgh seam coal. (3). The mechanism for dispersal of dust piles depended significantly on dust pile geometry, cohesiveness of dust, bulk density and compaction of dust, adhesive surface, and vibrations perturbing the supporting surface. Author

N69-23821# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PARTICLE DEPOSITION WITHIN A CURVED SAMPLING PROBE
G. A. Sehmel and L. C. Schwendiman *In Its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 88–92 (See N69-23812 12-13)
Avail: CFSTI

Particle deposition was measured in 4.7 to 5.8-in. lengths of 0.135 to 0.40 in. ID tubing formed on a 4.4 in. radius of curvature. For a constant sampling velocity, deposition increased with an increase in particle size and a decrease in tubing ID. For a constant tube ID, deposition increased with both flow rate and particle size until reentrainment became important. For transition flow between laminar and turbulent, the deposition was minimum for an intermediate Reynolds number for any constant particle size for which reentrainment was not important. The deposition was significant for all flow rates and must be considered in interpreting the data for any sample passed through a curved tube in either laminar or turbulent flow. Author (NSA)

N69-23822# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THE EFFECT OF SAMPLING PROBE DIAMETER ON SAMPLING ACCURACY
G. A. Sehmel and L. C. Schwendiman *In Its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., Vol. 2, pt. 3 Oct. 1968 p 92–95 refs (See N69-23812 12-13)
Avail: CFSTI

Isokinetic sampling of particles from an air stream is regarded as essential for greatest accuracy. Errors can, nevertheless, result from several sources even when the isokinetic condition is maintained. One such source is the size and shape of the sampling probe. A study was carried out in which uranine particles of a single size (1 to 28 μ diam) were isokinetically sampled through 0.135, 0.210, 0.245, and 0.402 in. ID probes whose inlets were located on the axis of a 2.81 in. ID vertical tube. Sampling velocities from 18.0 to 19.6 ft/sec were equal to the maximum centerline velocities of the sampled tube. The measured concentrations from the sampled air ranged from about 0.8 to 1.2 times the average concentrations in the sampled tube. The measured concentrations are a function of the probe diameter and also are affected by the preferentially enhanced concentration of large particles in the region next to the sampled tube wall. Author (NSA)

N69-23823# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PARTICLE COLLECTION EFFICIENCIES ON WIRES
G. A. Sehmel and L. C. Schwendiman *In Its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 96–100 refs (See N69-23812 12-13)
Avail: CFSTI

Collection efficiencies of monodispersed 4 to 27 μ uranine particles were determined for 0.020 in. diam wires for an air

velocity of 18.6ft/sec. The wires were covered with a thin layer of petroleum jelly. Collection efficiencies decreased as the projected wire area covered by particles increased above about 1%. This decrease has not been previously reported and may explain some of the scatter in literature values of impaction efficiencies.
Author (NSA)

N69-23825# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PARTICLE DEPOSITION VELOCITIES AND PARTICLE CONCENTRATION PROFILES ABOVE THE DEPOSITION SURFACES
G. A. Sehmel and L. C. Schwendiman *In Its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 103–108 refs (See N69-23812 12-13)
Avail: CFSTI

Particle deposition was measured for turbulent flow in 1.152 in. ID aluminum tubes. Simultaneously, particle concentration was measured as a function of distance from the deposition surfaces. Since the concentration may be maximum near the tube surface, the deposition is a more complex function of the observed concentration profiles than could be ascribed to simple diffusion models. Measurements of concentration profiles with observed deposition are needed to understand more fully the mechanisms of particle deposition.
Author (NSA)

N69-23871# Aeronautical Research Council (Gt. Brit.)
THE DERIVATION OF POWER SPECTRA OF DENSITY VARIATIONS IN HYPERSONIC WAKES FROM SCHLIEREN PHOTOGRAPHS
J. P. Thompson 1968 29 p refs Supersedes RAE-TR-67226; ARC-29905
(ARC-CP-1021; RAE-TR-67226; ARC-29905) Copyright. Avail: CFSTI; HMSO 6s

An analysis is given of the relationship between power spectra of image density variations in a schlieren film of a hypersonic wake and the power spectra of gas density variations in the wake. Some results are given for the application of this theory to the schlieren film produced in an R.A.R.D.E. hypervelocity range test.
Author (ESRO)

N69-23880# National Physical Lab., Teddington (England). Ship Div.
SOME COMMENTS ON THE PERFORMANCE IN CALM WATER OF A SINGLE-HULL TRAWLER FORM AND CORRESPONDING CATAMARAN SHIPS MADE UP FROM SYMMETRICAL AND ASYMMETRICAL HULLS
J. T. Everest Feb. 1969 25 p refs
(NPL-Ship-129) Avail: CFSTI

An investigation of the calm water performance of catamaran ships has been proceeding at Ship Division NPL for some time. The present study extends the earlier work, and considers the power requirements of catamaran ships for application as trawlers. Symmetrical and asymmetrical hulls derived from the lines of a good single hull form are included in the investigation together with some simple calm water performance comparisons between the catamaran ships and the parent trawler form. The basic investigation involved considerable wave pattern studies, and comment on the linearity of wavemaking effects is made; analyses of the measured total resistance are also included.
Author (ESRO)

N69-23887# Joint Publications Research Service, Washington, D. C.
DIFFRACTION OF UNSTEADY SURFACES AND INTERNAL WAVES
S. S. Voyt et al 7 Apr. 1969 9 p refs Transl. into ENGLISH from Fiz. Atmosfery i Okeana (Moscow), v. 5, no. 2, 1969 p 180–187
(JPRS-47790) Avail: CFSTI

The diffraction of surface and internal waves developing in an incompressible ideal heavy fluid as a result of the activation of a source is studied. Precise results have been obtained in the form of convolutions of the function, describing the output of the source, and in the form of transmission functions characterizing the fluid's reaction to a single influence. An asymptotic analysis of the results derived is conducted.

N69-24002# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ASYMMETRIC FLOW AROUND THE FRONTAL PART OF A BODY OF ROTATION BY A SUPERSONIC STREAM OF AN IDEAL OR REAL GAS
G. I. Kozlova et al May 1968 30 p refs Transl. into ENGLISH from Zh. Vychislitel'noi Mat. i Mat. Fiz. (Moscow), v. 7, no. 3, 1967 p 594–608
(AD-682826; FTD-MT-24-5-68) Avail: CFSTI CSCL 20/4

A method for calculating a supersonic flow past an asymmetric body of revolution is applied to the case of an airflow in the presence of dissociation and ionization. This approach makes use of the method of integral relations in its first approximation, with interpolation from the body to the shock with respect to two variables. A body-oriented asymmetric coordinate system is employed with origin at the stagnation point. The method makes it possible to calculate the flow over a spherical segment with respect to the angle of attack in the region of the angle of attack in which (1) the velocity on the entire surface of the segment is less than the velocity of sound on the surface and (2) the elliptical zone is adjacent only to a portion of the segment surface. The results of the calculation of the flow of a perfect gas over a disk and a spherical segment are substantiated by available experimental data.
Author (TAB)

N69-24058*# IIT Research Inst., Chicago, Ill.
EFFECT OF FREE STREAM TURBULENCE ON COAXIAL MIXING
R. A. Kulik, J. J. Leithem, and H. Weinstein Washington NASA May 1969 48 p refs
(Grant NsG-694)
(NASA-CR-1336) Avail: CFSTI CSCL 20D

The effects of free stream turbulence and boundary layer trip devices on mixing in a co-axial jet stream are presented. A screen of fine mesh placed in the outer infinite free stream effected both a boundary layer separation where screen and inner duct met, and a lowering of the free stream turbulence level. To determine the dominate effect of the screen, a boundary layer trip device was used to effect the boundary layer separation without reducing the free stream turbulence. Both air and air-Freon-12 systems with density ratios of 1 and 4 respectively, were studied. The outer stream velocity was kept constant at 51 ft/sec and the mass average velocity ratios varied from 2 to 20. Data are presented for the relative axial turbulence intensities as well as velocity, concentration, and mass holdup. Comparison of the screen and boundary layer trip device data taken without any such devices indicated that both devices effected the same preservation of the inner-stream integrity. Mixing is retarded by a factor of 2 to 4 for low velocity ratios.
Author

N69-24210# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Institut fuer Turbulenzforschung
TWO DIMENSIONAL SET CONTROL. PART I: A PLANE JET IN A STATIONARY OBLIQUE FLOW: THEORY [ZWEIDIMENSIONALE STRAHLSTEUERUNG TEIL I: EIN EBENER

FREISTRAHL IN EINER STATIONAEREN SEITLICHEN STROEMUNG THEORIE]
D. Bechert Feb. 1969 45 p refs in GERMAN; ENGLISH summary
(DLR-FB-69-11) Avail: CFSTI

The problem of the deflection of a plane jet by an oblique stream is treated theoretically. The investigations are limited to a plane jet, penetrating perpendicularly into a flow above a flat plane. The total heads of jet flow and deflecting flow are assumed to differ greatly. A nonlinear integro-differential equation for the problem is developed. For this equation, an approximate solution is given, which is valid for the whole region with only small numerical deviations. Author

N69-24211# Deutsche Versuchsanstalt fuer Luft-und Raumfahrt, Berlin (West Germany). Institut fuer Turbulenzforschung.
TWO-DIMENSIONAL JET CONTROL. PART 2: A PLANE JET WITH A WEDGE IN A STATIONARY OBLIQUE FLOW: THEORY [ZWEIDIMENSIONALE STRAHLSTEUERUNG TEIL 2: EIN EBENER FREISTRAHL MIT EINER SCHNEIDE IN STATIONAERER SEITLICHER STROEMUNG THEORIE]
D. Bechert Feb. 1969 30 p refs In GERMAN; ENGLISH Summary
(DLR-FB-69-12) Avail: CFSTI

A plane jet is directed towards a wedge (thin wall). The jet is deflected by an oblique flow. The trajectory of this jet is computed using an approximation method. In the calculation, the total heads of the jet flow and the deflecting flow are assumed to be greatly different. Starting from the jet exit, the calculation at first gives a nearly parabolic curvature. Near the wedge, the jet curvature becomes inverse and, far from the wedge, jet flow and wall finally become parallel. Author

N69-24212# Deutsche Versuchsanstalt fuer Luft-und Raumfahrt, Berlin (West Germany). Institut fuer Turbulenzforschung.
TWO-DIMENSIONAL JET CONTROL. PART 3: A PLANE JET IN A STATIONARY OBLIQUE FLOW WITH AND WITHOUT A WEDGE: MEASUREMENTS [ZWEIDIMENSIONALE STRAHLSTEUERUNG TEIL 3: EIN EBENER FREISTRAHL IN STATIONAERER SEITLICHER STROEMUNG OHNE UND MIT SCHNEIDE MESSUNGEN]
D. Bechert Feb. 1969 36 p refs In GERMAN; ENGLISH Summary
(DLR-FB-69-13) Avail: CFSTI

The deflection of a plane jet by an oblique flow with and without a wedge was the subject of an experimental investigation. A number of jet trajectories was measured by an automatic measuring device, using hot wire probes, automatic probe supports and an X-Y plotter. For the jet deflection in a free stream, two universal jet trajectories were found, one for a wall limitation of the wake behind the jet and one for the unlimited wake. The deflection of a jet with a wedge was found to be a one-parameter problem, as predicted. The agreement between measurements and the results of the previous theoretical investigations is good. Author

N69-24443# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
MIXING OF GASEOUS WAKE JETS
O. I. Navoznov and A. A. Pavelev Sep. 1968 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (USSR), no. 2, 1968 p 52–67
(Contract NOw-62-0604)
(AD-680667; APL-CLB-3-T-565) Avail: CFSTI CSCL 20/4

The dependence of average flow parameters and dimensions of the mixing zones of two coaxial jets of an incompressible gas upon the initial conditions was determined experimentally. Different initial conditions were created by mounting fine-mesh grids in the initial section of the flow. When grids of 0.07 mm mesh size are used, the ordinate of the inner boundary of the mixing zone decreases linearly down to a wake flow velocity ratio of m = 0.88, whereas in the absence of grids at the exit plane mixing no longer depends on the velocity ratio, starting with m = 0.5, and is completely determined by boundary layer parameters at the nozzle wall separating the two flows. A relation was found between mixing and density ratio for submerged jets of different density flowing into different media. The density ratio varied from 7 (for an air jet in a helium atmosphere) to 30 (for a helium jet in a Freon-12 atmosphere). Author (TAB)

N69-24449# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTS ON ROUGHNESS EFFECTS ON BOUNDARY-LAYER TRANSITION UP TO MACH 16 Final Technical Report, 1 Sep. 1966–27 Jul. 1967
Jack D. Whitfield and F. A. Iannuzzi AEDC Jan. 1969 36 p refs
(Contract F40600-69-C-0001)
(AD-680398; AEDC-TR-68-261) Avail: CFSTI CSCL 20/4

Free-stream Mach number 14 to 16 experiments in a high Reynolds number hotshot-type wind tunnel with a sharp 9-deg cone model under relatively cold-wall conditions are presented that reveal the expected strong influence of Mach number and a unit Reynolds number effect similar to that obtained in conventional wind tunnels. Comparison of cone and hollow cylinder (i.e., equivalent to a flat plate) transition Reynolds numbers from several wind tunnels and ranges fails to reveal a conclusive picture concerning the relationship of cone and flat-plate transition Reynolds numbers. The effectiveness of spherical roughness in promoting premature boundary-layer transition is shown to decrease exponentially with increasing Mach number. The results compare favorably with the hypersonic extension proposed by Potter and Whitfield for their original correlation. It is shown that care must be exercised in selecting the physical roughness size at hypersonic speeds because of possible flow field distortion. Author (TAB)

N69-24502# National Aeronautical Establishment, Ottawa (Ontario).
NON-UNIFORM PROPAGATION OF MODERATE STRENGTH BLAST WAVES IN WEDGE AND CONICAL HYPERSONIC NOZZLES
B. H. K. Lee Jun. 1968 28 p refs
(AD-680471; NAE-LR-505; NRC-10409) Avail: Issuing Activity CSCL 20/4

The blast wave equations in an unsteady environment are derived. For wedge and conical nozzles it is shown that the density has a power law variation with distance downstream from the throat when the local flow Mach number is large. The unsteady flow field behind the blast wave is solved by a perturbation technique and the self-similar solution of Mirels and Mullen is recovered in the first approximation. An approximate expression is given for the shock trajectory as a function of the instantaneous energy release, the nozzle geometry, and the stagnation conditions. Author (TAB)

N69-24508# Lockheed Missiles and Space Co., Palo Alto, Calif.
ASYMPTOTIC INVESTIGATION OF TRANSONIC FLOWS
V. B. Gorskii [1968] 4 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR. Mekh. Zhidk. Gaza (Moscow), no. 6, 1968 p 102–106
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Second and third approximation equations are derived for the stream functions of plane and axisymmetric irrotational transonic inviscid gas flow. Particular solutions of the symtotic equations are found for a plane nozzle and an axisymmetric nozzle. Author

N69-24518# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF CHARACTERISTICS FOR CALCULATION OF TWO-DIMENSIONAL VORTEX FLOWS OF EQUILIBRIUM AND IDEAL GAS
Yu. N. Dyakonov, L. V. Pchelkina, and I. D. Sandomirskaya Apr. 1968 27 p refs Transl. into ENGLISH from Moscow Univ. Vychislitelnyi Tsentr. Sb. Rabot (USSR), no. 7, 1967 p 206–224
(AD-680350; FTD-MT-24-81-68) Avail: CFSTI CSCL 20/4

Since results of calculations of flow around blunt bodies by ideal and equilibrium gas are of considerable interest, the scheme of method of characteristics was selected so that the corresponding program for electronic digital computers is universal, i.e., with its use one can calculate flow by taking into account equilibrium physicochemical reactions or by disregarding them. Results are presented of these calculations. Results of calculations are analyzed and compared with some conclusions of theory of hypersonic flows. Author (TAB)

N69-24524# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
CHARACTERISTICS OF A TURBULENT WAKE UNDER GRADIENT FLOW CONDITIONS
L. N. Uhkhanova Oct. 1968 19 p refs Transl. into ENGLISH from Prom. Aerodinamika (USSR), no. 27, 1966 71–82
(Contract NOw-62-0604)
(AD-680685; APL-CLB-3-T-569) Avail: CFSTI CSCL 20/4

Results are given of experimental studies of turbulent wakes in the plane and axisymmetric cases under positive and negative longitudinal pressure gradients and an approximate method of calculating such wakes is discussed. A positive longitudinal pressure gradient promotes more rapid decay of a turbulent wake than in the zero gradient case, whereas the opposite is true for a negative pressure gradient. Author (TAB)

N69-24561# ARO, Inc., Arnold Air Force Station, Tenn.
TURBULENT MIXING AND BURNING OF COAXIAL STREAMS INSIDE A DUCT OF ARBITRARY SHAPE Final Report
C. E. Peters AEDC Jan. 1969 205 p refs
(Contract F40600-69-C-0001)
(AD-680397; AEDC-TR-68-270) Avail: CFSTI CSCL 20/4

A theoretical investigation of the ducted turbulent mixing of coaxial streams is presented. The effects of equilibrium chemical reactions in the mixing layer are included in the analysis. In Part I, the theory is developed for ducted mixing systems in which the inviscid portions of the flow are assumed to be one-dimensional. The integral method is used, and the mixing zone velocity profiles are assumed to be similar. Turbulent Prandtl and Lewis numbers are assumed to be unity, and the turbulent shear stress along one control surface in the mixing layer is computed by use of a semi-empirical model for the eddy viscosity. The theory is formulated to include the downstream regime where the mixing layer extends across the entire duct. The system of integral equations is transformed into a form suitable for numerical solution by standard methods. In Part II, the theory is extended to include the influence of a nonuniform supersonic inviscid core flow. A technique is developed for coupling the numerical solution of the inviscid core flow (from the method of characteristics) with the solution of the integral equations for the mixing layer. The theory is correlated with low speed experiments, with supersonic air-air ejector experiments and with experiments on ducted rocket-air mixing. The correlations show that the theory gives satisfactory results for the performance of ducted rocket-air mixing systems which are representative of air augmented rockets. Author (TAB)

N69-24629# Royal Aircraft Establishment, Farnborough (England)
THE PHYSICAL PROPERTIES OF A FLOW IN THE SEPARATION REGION FOR THE THREEDIMENSIONAL INTERACTION OF THE BOUNDARY LAYER WITH A SHOCK WAVE [FIZICHESKIE OSOBENNOSTI TECHENYA V OBLASTI OTRYVA PRI TREKHMERNOM VZAIMODEISTVII POGRANICHNOGO SLOYA S UDARNOI VOLNOI]
V. S. Avduyevskii et al Jan. 1969 15 p refs Transl. into ENGLISH from Mekhan. Zhidkosti i Gaza, (USSR), no. 1, 1967
(RAE-Lib-Trans-1342) Avail: CFSTI

A discussion is presented on a three dimensional supersonic flow in the plane of symmetry in the region of the shock–boundary layer interaction arising in front of an obstacle mounted on a plate. The fundamental characteristic of such a flow is the penetration of streams of ideal fluid into the separation region and the formation at the surface of the plate and the obstacle of narrow sectors with high pressures, high velocity gradients and high heat transfer coefficients. Pressure distributions were measured and shadow and Toepler schlieren photographs together with surface flow pictures indicate the flow pattern near the surface. The chief physical features of the separated flow were established. The independence of the length of the separation region and the thickness of the boundary layer was proved. Local supersonic flows in the separation region were detected, the effect of the angle of the separated flow and the sweep angle of the obstacles on the flow was determined, and characteristic flow zones in the region of the interaction were isolated. Author

N69-24689# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF LOCAL MASS TRANSFER WITH FLOW OF A TURBULENT STREAM OF AIR AROUND RECTANGULAR CAVITIES
V. P. Popov and E. A. Vagner Jul. 1968 26 p refs Transl. into ENGLISH from the book "Issledovanie Nestatsionarnogo Teplo i Massoobmena" Nauka, Minsk, 1966 p 161–177
(AD-681801; FTD-MT-24-153-68) Avail: CFSTI CSCL 20/4

An analysis was made of the mass transfer in open and closed zones around a cavity. Experiments were carried out in hydraulic troughs at Reynolds numbers 8500 and 2500. TAB

N69-24703# Naval Ordnance Lab., White Oak, Md.
A SOURCE-SINK PROBLEM
Stuart Brodsky Oct. 1968 18 p
(AD-682920; NOLTR-68-166) Avail: CFSTI CSCL 20/4

Considered is the problem of a three dimensional source and sink whose strengths are growing like t squared and moving with constant velocities -w and +w respectively from the origin at t = 0 along one of the coordinate axes. This problem is shown to be a self-similar problem and a qualitative discussion is made of its solution. TAB

N69-24734# Mechanical Technology, Inc., Latham, N. Y.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF TURBULENT FLOW IN BEARING FILMS, INCLUDING CONVECTIVE FLUID INERTIA FORCES Topical Report, Feb.–Oct. 1968
A. J. Smalley, J. H. Vohr, V. Castelli, and C. Wachmann Dec. 1968 109 p refs
(Contract AT(30-1)-3930)
(NYO-3930-2; MTI-68-TR-80) Avail: CFSTI

An analysis of hydrodynamic lubrication of bearings which takes full account of fluid film turbulence and effects of fluid convective inertial was developed. The analysis developed is applied to pad bearings of arbitrary geometry, and has been incorporated in a computer program to calculate the film pressures developed in such bearings. Results from this program are compared with

experimental pressure profile measurements made on a 12-in. dia, four pad, shrouded step bearing with silicone fluids as test lubricants. The main conclusions reached were: the theory of full turbulent inertial conditions in pad-type bearings has been verified by experimental comparison; the effects of both fluid inertia and film turbulence tend to increase the peak pressures attained in a bearing; a major characteristic of convective inertial effects is that they tend to produce a very sharp drop in pressure at the step at the end of a pocket. NSA

N69-24736# California Univ., Los Angeles. Numerical Analysis Research.
THE EFFECT OF SIDEWALLS ON THE POROUS-MEDIUM SPIN-UP PROBLEM
Louis N. Howard 1968 19 p refs Prepared in cooperation with MIT
(Contracts Nonr-233(78); DA-31-124-ARO(D)-355)
(AD-680252) Avail: CFSTI CSCL 20/4

The document contains a mathematical analysis of vertical movements of components in a rotating fluid. TAB

N69-24739# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
SUPERSONIC SEPARATED FLOWS OVER WEDGES AND FLARES WITH EMPHASIS ON A METHOD OF DETECTING TRANSITION Final Scientific Report, 1 May 1967–30 Apr. 1968
Jean J. Ginoux Aug. 1968 47 p refs
(Contract AF-EOAR-51-67)
(AD-680257; VKI-TN-7) Avail: CFSTI CSCL 20/4

The investigation is a first step to the study of the effect of cross flow in laminar separation at supersonic speeds. It is related to the selection of a final axi-symmetric model. Several problems were examined: first, the effect of streamwise vortices that develop systematically in laminar reattaching flows, triggered by small irregularities in the leading edge thickness; second, the choice of the diameter of the model such that the flow resembles that on an equivalent planar body; third, the programming of Lees-Reeves theory on a 1130 IBM computer to perform a parametric study; and finally the development of a new accurate technique or criteria to ascertain that fully laminar shock wave boundary layer interactions can be obtained. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N69-23455# Royal Aircraft Establishment, Farnborough (England).
TEMPERATURE AND DENSITY OF THE THERMOSPHERE, 1966–1967 [TEMPERATURA I PLOTNOST' TERMOSFERY]
M. Ya. Marov et al Jan. 1969 19 p refs Transl. into ENGLISH from Russian Report
(RAE-Lib-Trans-1337) Avail: CFSTI

The values and variations of the density and temperature of the thermosphere at heights of 180–300 km are discussed using data on the retardation of Soviet artificial earth satellites in the period of mean solar activity. The validity of CIRA 1965 models for these heights is critically appraised for indices corresponding to the flux of solar decimetric radiation for the period 1966–67. Author

N69-23529*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ROLE OF ATOMIC OXYGEN IN THE IONOSPHERIC E AND F REGION BEHAVIOR
J. R. Herman and S. Chandra Nov. 1968 26 p refs Submitted for Publication
(NASA-TM-X-63517; X-615-68-436) Avail: CFSTI CSCL 04A

The continuity and heat conduction equations for the electron, ion, and neutral gases are solved simultaneously to show the effect of using the heat loss arising from the excitation of the fine structure levels of atomic oxygen, and the heat input from a height dependent electron heating efficiency. The solutions are compared to backscatter data obtained under conditions similar to those used in the theoretical model. A family of solutions is presented for three different values of the atomic oxygen density at the turbopause level, and compares favorably to certain widely observed features of the main phase of a magnetic storm. From the comparison, it is shown that the results of decreasing the atomic oxygen density at the turbopause level are consistent with the observed changes in both the neutral and ionized constituents relative to quiet magnetic conditions. Author

N69-23535*# Volt Information Sciences, Inc., Washington, D. C.
INVESTIGATION OF THE RELATIONSHIP BETWEEN THE UPPER IONOSPHERE DRIFTS AND THE CURRENTS SYSTEMS OF THE DYNAMO-REGION AT MIDDLE AND HIGH LATITUDES
A. A. Kashin Greenbelt, Md. NASA. Goddard Space Flight Center 21 Apr. 1969 7 p refs Transl. into ENGLISH from Vestn. Mosk. Univ. (Moscow), no. 1, 1969 p 51–54
(Contract NAS5-12487)
(NASA-CR-100687; ST-AI-GM-10829) Avail: CFSTI CSCL 04A

The behavior of the drift of ionosphere's F_2- region is considered from the standpoint of the motor theory. The observed drift is compared with the computed one and with the daily course of the horizontal component of the Earth's magnetic field. The relationship between the current system of the dynamo-region and the drift in the F_2-region of the ionosphere at middle and high latitudes is confirmed. Author

N69-23536*# Volt Information Sciences, Inc., Washington, D. C.
SOME PECULIARITIES OF PLASMA MOTIONS IN THE EARTH'S MAGNETOSPHERE
M. V. Samokhin Greenbelt, Md. NASA. Goddard Space Flight Center 16 Apr. 1969 13 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 9, no. 1, 1969 p 16–22
(Contract NAS5-12487)
(NASA-CR-100690; ST-PF-PFL-10826) Avail: CFSTI CSCL 04A

The motion of matter inside the Earth's magnetosphere is investigated in this paper. It is shown that at flow with free boundary inside the magnetosphere, there sets in an eddy current, whereupon the matter velocity changes sign as it passes through the frontal point. As an example, the structure of the vortex flow is investigated in the incompressible fluid with the forbidden zone having the shape of a cylinder or a sphere. Investigated also is the quasi-hydrodynamic flow in the vicinity of the frontal point. Author

N69-23557*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTATION OF TOPSIDE IONOGRAMS FROM N(h) PROFILES
Lawrence Colin, Kwok-Long Chan, and Jack G. K. Lee (Informatics, Inc., Palo Alto, Calif.) Washington Apr. 1969 35 p refs
(NASA-TN-D-5052) Avail: CFSTI CSCL 04A

Model profiles of plasma frequency and gyrofrequency are chosen to simulate typical conditions observed in the topside ionosphere by the Alouette I sounder (1000 km) and the Alouette II sounder near apogee (3000 km). Examples of group refractive index profiles for these models are presented. By means of parabolic-in-log X lamination techniques applied to the plasma frequency profiles, cumulative delays are computed to illustrate the relative delays contributed by each lamination to the formation of topside ionograms. Complete ionograms (ordinary, extraordinary, and Z traces) are presented for all the models. Implications of the results to the inverse experimental problem of scaling ionogram data and computing electron concentration profiles are discussed. Author

N69-23564# Israel Program for Scientific Translations, Ltd., Jerusalem.
THEORY OF SOIL MOISTURE. VOLUME 1: MOISTURE PROPERTIES OF SOILS AND MOVEMENT OF SOIL MOISTURE
A. A. Rode 1969 571 p refs Transl. into ENGLISH of the book "Osnovy Ucheniya o Pochvennoi Vlage. Volume 1: Vodnye Svoistva Pochv i Peredvizhenie Pochvennoi Vlagi" Leningrad, Gidromet. Izd., 1965 Published for Dept. of Agr. and NSF *Its* Cat. No. 5272
(TT-68-50441) Copyright. Avail: CFSTI

It is seen that the study of the water properties of soils and of the properties and behavior of soil water has followed two main directions. The first involves experiments and observations under field conditions, in which the object under study is the soil layer as a whole in its native state. The second approach consists in laboratory experiments (carried out mainly on ground soil samples), and in extensive mathematical analysis of the effects related to the migration of water in the soil. Such an analysis presupposes an analogy between the stream of water in the soil and an electric or a thermal current. A discussion of both approaches and a survey of the most valuable and interesting studies of both schools are presented. Author

N69-23573# National Environmental Satellite Center, Washington, D. C.
A POLYNOMIAL REPRESENTATION OF CARBON DIOXIDE AND WATER VAPOR TRANSMISSION
William L. Smith Feb. 1969 23 p refs
(NESC-47) Avail: CFSTI

An eight-term model is found adequate for diagnosing tabulated transmittance data of 5 cm^{-1} resolution with an RMS difference of about 1 percent transmission. Comparisons between transmittances calculated with the polynomial model and experimentally observed transmittances are presented. The agreement appears close to the experimental errors. The empirical model is utilized to calculate the upward radiance spectrum at the 8-mb level over Palestine, Tex. Agreement with radiance observations made by a balloon-borne interferometer is fair for most spectral intervals. Author

N69-23613 California Univ., San Diego.
ATMOSPHERIC DUST RECORDS IN GLACIAL SNOWFIELDS: IMPLICATIONS TO MARINE SEDIMENTATION
Herbert Lynn Windom (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-13808

The contributions of atmospherically transported solids to marine sediments were investigated by the dust accumulation in glacial snowfields. Seven snowfields, including the Antarctic and Greenland ice sheets and five associated with temperate glaciers, were studied. Lead-210 geochronology was used to ascertain rates of snow accumulation and of dust fallout. Semiquantitative mineralogical and size analyses were carried out on the particulate matter in the ice samples. The results indicate that the dust comes from material derived from local and distant (global) sources. The composition of the global component is dependent on sources under its wind system, while that of the local component is dependent on the regional geology and physiography of the sampling area. Dissert. Abstr.

N69-23614 Houston Univ., Tex.
IDENTIFICATION OF THE EARTH'S GEOPOTENTIAL
Carl Clayton Holloway, Jr. (Ph.D. Thesis) 1968 64 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-13800

A method to accurately determine certain constants appearing in mathematical representations of the gravitational field of the earth and other effects such as high altitude drag forces, based on observations of a satellite's orbit, is illustrated. The method employs a quasilinearization technique, numerical integration of linear and nonlinear differential equations, least squares fitting criteria, and matrix inversion to determine estimates of parameters and initial conditions. Several mathematical representations of the earth's gravitational field are reviewed, and current mathematical techniques for the evaluation are discussed. Calculations are performed to verify the method using numerically generated data. Dissert. Abstr.

N69-23658 Colorado Univ., Boulder.
A NUMERICAL INVESTIGATION OF HYDRODYNAMIC INSTABILITY AND ENERGY CONVERSIONS IN THE QUASI-GEOSTROPHIC ATMOSPHERE
John Atkins Brown, Jr. (Ph.D. Thesis) 1968 226 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-14371

The hydrodynamic instability characteristics of planetary zonal flows are investigated through use of a quasi-geostrophic model of high spatial resolution. An initial-value-problem technique is employed to obtain solutions of the linear problem. This numerical procedure resolves the most unstable mode of the algebraic system of equations most rapidly when the perturbation amplification rate is large. The feasibility of the technique is tested on simplified atmospheres capable of either baroclinic or barotropic instabilities and for which analytical solutions are available. These tests are also used to demonstrate the influences of the atmospheric gravitational stability, the planetary vorticity gradient and the vertical resolution of the model. Certain zonal flows containing both vertical and lateral shears, which are representative of those observed in the earth's atmosphere, are found to be unstable with respect to the large-scale quasi-geostrophic disturbances. Dissert. Abstr.

N69-23677# National Environmental Satellite Center, Washington, D. C.
STATISTICAL ESTIMATION OF THE ATMOSPHERE'S GEOPOTENTIAL HEIGHT DISTRIBUTION FROM SATELLITE RADIATION MEASUREMENTS
William L. Smith Feb. 1969 33 p refs
(NESC-48) Avail: CFSTI

This procedure makes use of geopotential satellite radiation measurements, particularly those to be made by the Satellite Infrared Radiation Spectrometer (SIRS) which is to fly on the Nimbus III meteorological satellite. Regression relations between radiance, temperature, and geopotential height are derived, a method for minimizing the influence of clouds on the solutions is described, and the statistical procedure for computing the height and temperature profiles from the regression equations and satellite observations of radiance is presented. Synthetic radiance observations from radiosonde measurements are used to test the statistical procedure. Author

N69-23737*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DERIVATION OF THE INTERNATIONAL GEOMAGNETIC REFERENCE FIELD [IGRF (10/68)]. A REPORT TO IAGA COMMISSION 2, WORKING GROUP 4
Joseph C. Cain and Shirley J. Cain Dec. 1968 43 p refs Submitted for publication
(NASA-TM-X-63520; X-612-68-501) Avail: CFSTI CSCL 20C

The testing of the various magnetic field models against the available World Magnetic Survey data is summarized, and the method by which the first International Geomagnetic Reference Field [IGRF(10/68)] was derived is described. The IGRF(10/68) was composed of contributions of the field models derived by Goddard Space Flight Center, Air Force Cambridge Research Laboratories, Royal Greenwich Observatory, Institute of Terrestrial Magnetism and Radiowave Propagation, and the U.S. Coast and Geodetic Survey. The IGRF(10/68) is a set of 80 internal spherical harmonic coefficients and their first time derivatives epoch 1965.0 referenced to a sphere 6371.2 km radius. The root-mean-square residuals to surface and airborne magnetic survey data taken during the interval 1961 through 1965 average about 200γ. The rms deviations from selected COSMOS-49 (1964.7) and POGO (1965.8–1967.9) total field satellite observations range from 30 to 80γ. Author

N69-23740# Technische Hochschule Munchen (West Germany). Fakultaet fuer Bauwesen.
DRAINAGE PREDICTION OF GROUNDWATER STORAGE [ABFLUSSVORHERSAGEN AUS GRUNDWASSERVORRAETEN]
Fritz Heinrichsdorf (Ph.D. Thesis) 1968 70 p refs In GERMAN
Avail: CFSTI

A mathematical model is formulated and used to predict quantitatively the groundwater table and discharge dynamics in the vicinity of Munich, Germany. The statistical analysis considers precipitation and temperature effects as well as time and duration of the drainage problem. Transl. by G.G.

N69-23786*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ION DEPLETION IN THE HIGH LATITUDE EXOSPHERE; SIMULTANEOUS OGO-2 OBSERVATIONS OF THE LIGHT ION TROUGH AND THE VLF CUTOFF
H. A. Taylor, Jr., H. C. Brinton, D. L. Carpenter (Stanford Univ.), F. M. Bonner (Aero Geo Astro Co., College Park, Md.), and R. L. Heybome (Utah State Univ.) Mar. 1969 33 p refs Submitted for publication
(Contract NAS5-3093; Grant NGR-05-020-288)
(NASA-TM-X-63525; X-621-69-84) Avail: CFSTI CSCL 04A

Simultaneous observations of positive ion composition, vlf earth to satellite transmission, and whistlers, were obtained from the OGO-2 satellite in a polar, dawn–dusk orbit. As the satellite moved poleward above about 55° invariant latitude, sudden depletions of the light ion components of the topside ionosphere were observed. Poleward of the trough, the depleted light ion distributions were characterized by rapid fluctuations in concentration which appeared to correlate in some cases with significant enhancements in the vlf noise level. The combined evidence of the light ion depletion and vlf cutoff further identified the plasmapause as the often abrupt boundary of the plasmasphere. The abruptness of the light ion trough suggested the possibility that the mechanism responsible for the depletion results in a sharply defined heating and upward expansion of the lower atmosphere. Limited evidence of vlf absorption as well as abrupt increases in neutral density near the trough zone appear consistant with this possibility. Author

N69-23810*# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.
ROCKET MEASUREMENT OF NITRIC OXIDE BETWEEN 60 AND 96 KILOMETERS
J. B. Pearce [1968] 34 p refs
(Grant NGR-06-003-064)
(NASA-CR-100729) Avail: CFSTI CSCL 04A

The height profile of the nitric oxide airglow in the gamma bands is presented from measurements by a sounding rocket at evening twilight. The nitric oxide density profile is deduced from these measurements. The density profile is used to deduce the dominant processes controlling nitric oxide in the 60 to 96 kilometer range. Above 75 kilometers the dominant process is found to be atmospheric mixing. The chemical reaction of nitric oxide with ozone is suggested as the dominant process below 70 kilometers. Author

N69-23812# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ANNUAL REPORT FOR 1967 TO THE USAEC DIVISION OF BIOLOGY AND MEDICINE VOLUME 2: PHYSICAL SCIENCES. PART 3: ATMOSPHERIC SCIENCES
D. W. Pearce, ed. Oct. 1968 204 p refs
(Contract AT(45-1)-1830)
(BNWL-715-3) Avail: CFSTI

The research data presented pertain to air sampling, particle deposition, atmospheric turbulence, precipitation scavenging, tracer systems, and air monitoring. For individual titles, see N69-23813 through N69-23836.

N69-23813# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
REAL TIME SAMPLING OF ZINC SULFIDE TRACER IN DIFFUSION STUDIES
W. L. Dotson, P. W. Nickola, and M. A. Wolf *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 1-12 refs (See N69-23812 12-13)
Avail: CFSTI

A series of experiments were performed to measure the atmospheric diffusion of zinc sulfide tracer plumes using both ground-level and aircraft-mounted real time samplers. The results are compared and methods for intepreting the data are explained. NSA

N69-23814# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THE USE OF INSTANTANEOUS PLUME MEASUREMENTS TO APPROXIMATE A MEAN PLUME
J. V. Ramsdell *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 12-18 refs (See N69-23812 12-13)
Avail: CFSTI

A study is described that was undertaken to determine, from experimental data, the interrelationship between the instantaneous and mean properties of diffusing plumes. This has practical application since it is sometimes possible to measure only the instantaneous properties of a diffusing plume. A number of diffusion experiments were conducted at Hanford and in an Air Force study in which both instantaneous and mean measurement of the same plume were measured. An analysis of 12 of these tests demonstrates a rudimentary capability to transform instantaneous plume measurements to mean plume properties. NSA

N69-23815# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DIFFUSION OVER COASTAL MOUNTAINS OF SOUTHERN CALIFORNIA

W. T. Hinds *In its* Ann. rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 19-53 refs (See N69-23812 12-13)
Avail: CFSTI

Results from a large-scale program of diffusion studies, named Operation Mountain Iron, conducted by the Air Force, and carried out over the coastal mountains of Southern California are presented. Measurements were made for continuous ground level releases of about 15 to 30 sec duration. The site and experimental techniques are described. The data, their availability, and the development of techniques for estimating plume width are discussed. The results are compared with those from flatter terrain in the same climate. NSA

N69-23819# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THE MEASUREMENT OF PARTICULATE PLUME DEPLETION IN THE ATMOSPHERE BY COMPARISON WITH AN INERT GASEOUS TRACER
P. W. Nickola and J. D. Ludwick *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 65-73 refs (See N69-23812 12-13)
Avail: CFSTI

The depletion of a plume of fluorescent particles (FP 2210) was computed by comparing it to a plume of a nondepleting noble gas (^{85}Kr). Both plumes were released simultaneously from a common source at an elevation of 1.5 meters. Exposure measurements were made on a grid of samplers at distances of 200 m and 800 m from the source. The sampling array included samplers on 10 towers. It was found that, during traversal of the distance from 200 m to randomly m from the source, 16% of the particulates in the plume was depleted. Depletion was highest near the surface. At breathing level (1.5 m) at 800 m, the crosswind integrated exposure of the particulate plume was found to be only half that of the inert gas plume. Author (NSA)

N69-23826# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ATMOSPHERIC TURBULENCE STUDIES
C. E. Elderkin *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 109-113 refs (See N69-23812 12-13)
Avail: CFSTI

Research on atmospheric boundary layer turbulence continued with both empirical and theoretical studies. The theoretical work dealt with diabatic effects on spectral shapes and shifts. The assumptions made and calculation methods used are explained, and measured spectra are compared with the magnitude of spectral estimates in the inertial subrange. The empirical work dealt with improved instrumentation and data collection procedures which will provide temperature fluctuation data simultaneously with three-wind component data for conditions of large stability and instability. NSA

N69-23827# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
COMPARISON OF TURBULENCE SPECTRA FROM HANFORD, WASHINGTON, AND LIBERAL, KANSAS
C. E. Elderkin *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 113-120 refs (See N69-23812 12-13)
Avail: CFSTI

The turbulence spectra for each of the three wind components measured under a variety of wind speed and stability conditions at Hanford, Washington are compared with the spectra for a single test in slightly unstable conditions at Liberal, Kansas. The instrumentation and procedures used to obtain the data are described. The results show considerable agreement in the two sets of data and indicate that the considerable difference in surface roughness at the two sites has no noticeable effect on the spectra for unstable conditions. Further comparisons of the spectra at the two sites is recommended, particularly for stable conditions. NSA

N69-23828# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ON A GENERAL RELATION BETWEEN AUTOCORRELOGRAMS AND VARIANCE
W. T. Hinds *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p120-127 refs (See N69-23812 12-13)
Avail: CFSTI

The statistics of randomly fluctuating variables were useful in analyzing atmospheric motions and behavior. The mathematical results of smoothing the random variable before the statistics are calculated are examined, and calculated values are compared with measured data. It is concluded that this approach to calculating the variance of an increasingly smoothed variable leads to workable results with simple equations, and that this statistical method may provide a usable tool for working with rather complex functions and relations. NSA

N69-23829# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EXPERIMENTAL STUDIES IN PRECIPITATION SCAVENGING
M. T. Dana and M. A. Wolf *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 128-140 refs (See N69-23812 12-13)
Avail: CFSTI

Results are presented from six tests which measured the quantity, rate, and surface distribution of particle deposition from aerosols which contained silver iodide or fluorescein and which were released under various precipitation conditions. The mass removed by dry deposition and by washout in each test and the effect of precipitation rate on the washout coefficients were calculated. Further tests are recommended. NSA

N69-23832# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PRECIPITATION SCAVENGING OF SUBMICRON PARTICLES: A THEORETICAL ANALYSIS
W. G. N. Slinn *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 154-161 refs (See N69-23812 12-13)
Avail: CFSTI

A theoretical analysis is made of precipitation scavenging of extremely small particles (radii from 10 to 1000 Å) and how such particles are washed out of the atmosphere by rain of given intensity and of given raindrop size distribution. Equations are developed for particular solutions, for approximate solutions, and for a heat transfer analogy. This analysis leads to the conclusion that inertial effects are insignificant if the particle radius is less than 0.1 micron, and that heat transfer data are expected to be valuable for calculating the contribution to the washout coefficient from convective diffusion. NSA

N69-23833# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PRECIPITATION SCAVENGING OF SUBMICRON PARTICLES: A COMPARISON OF THEORY WITH FIELD RESULTS

D. I. Hagen *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 165-170 refs (See N69-23812 12-13)
Avail: CFSTI

Washout coefficients were measured in the field for the scavenging by rain of silver iodide particles purported to be smaller than 0.1 micron. The field results are compared with values calculated from diffusion theory. It was shown that, by ignoring electrical effects and assuming perfect retention of the particles by the drop, the washout equation becomes similar to that used by Engelmann to predict the washout of perfectly soluble gases, and, within experimental error, agrees with the field results. NSA

N69-23834# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THE CONVECTIVE DIFFUSION EQUATION FOR THE SCAVENGING OF SUBMICRON PARTICLES
W. G. N. Slinn *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 171-183 refs (See N69-23812 12-13)
Avail: CFSTI

Washout by rain of submicron particles of radii from 10 to 1000 Å is discussed, and a method for mathematically describing the stochastic force on a Brownian particle, i.e., the convective diffusion equation for the scavenging of submicron particles, is derived. NSA

N69-23858# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 201 1 Apr. 1969 p 44-60 (See N69-23855 12-34)
Avail: CFSTI

The return of the Vityaz from a south Pacific cruise is reported; a book review on fish resources is mentioned. Scientific abstracts are presented for the following studies: heat flux through the floor of the Arctic basin, sea floor sedimentation in the northeast Atlantic, the genesis of frontal zones in the southern ocean, turbulence as an ocean noise source, sound scattering by the ocean surface, modeling methods for determining the characteristics of sound propagation in the sea, nonuniform sea medium variation parameters, equations of state for sea water, measurement of the fluctuating transparency of sea water, deposits and muddy waters of the Norwegian Sea, the geological structure of the Norwegian Sea, the faunal nature of sea floor deposits, the distribution of suspended matter in bottom sea layers, factors involved in background oceanological forecasts, vertical movement of the coasts of Arctic seas, waters of the continental slope, hydrochemical studies and results, currents in the north Atlantic, hydrological conditions in the Norwegian Sea, and the radioactivity of air and water in the northeast Atlantic. P.A.B.

N69-23859# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 201 1 Apr. 1969 p 61-74 (See N69-23855 12-34)
Avail: CFSTI

Soviet use of seismic sounding in Antarctica, the Tadzhik earthquake, methods for exciting elastic vibrations in water, and the use of a special template for making topographic corrections in gravity surveys are reported. Abstracts are presented in the following areas: the use of exchange waves in deep seismic sounding, an anomaly in electrical conductivity at the crustal–mantle boundary, the relationship between crustal and upper mantle structure, a study of metal spherulets from the region of fall of the Tunguska meteorite, 1960 to 1965 world isopor maps, the excitation of micropulsations in the solar activity cycle, geomagnetic field pulsations in relation to geomagnetic and solar activity, humidity corrections for quartz variometers, viscous flow of the asthenosphere under island arcs, an analysis of Bouguer anomalies in the oceans, a literature review on the earth's tectonosphere, the deep structure of western Ciscaucasia, the absence of a granitic layer in south Caspian and Black Sea type depressions, methods for averaging the form of wave recording, and the mechanism of reverse magnetiziation of rock. P.A.B.

N69-23860# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 201 1 Apr. 1969 p 75-99 (See N69-23855 12-34)
Avail: CFSTI

TASS reports on Kosmos 266, 267, 268, 269, and 270 launchings are presented. Abstracts include: a comparison of drifts of meteor trails; the behavior of diurnal variation in cosmic rays; altitudinal dependence of drift of ionospheric inhomogeneities; the use of whistlers for detecting geomagnetic field disturbances; electron gas heating at the altitudes of effect E region; periodic movements of a satellite with a magnetic damper; the effect of scatter of initial data on moon–earth return trajectories; optimum regimes of space vehicle approach; drift in the upper ionosphere and current systems in the dynamo region; the luminescence spectra of nitrogen, oxygen, and air; polar type absorption in the middle latitude ionosphere; atmospheric density studies on the basis of meteor data; radioactivity distribution at various atmospheric altitudes; the contribution of corpuscular radiation to D layer ionization; sources of E region heating; low energy proton flux near the moon; cosmic proton and interplanetary plasma interactions; meteor luminescence and ionization; F region temperature and N(h) parameters during a strong magnetic-ionospheric IQSY storm, and ionospheric data usage for determining electron flux parameters. P.A.B.

N69-23896# Israel Program for Scientific Translations, Ltd., Jerusalem.
GEOGRAPHY AND CLASSIFICATION OF SOILS OF ASIA
V. A. Kovda, ed. et al 1968 277 p refs Transl. into ENGLISH of the publ. "Geografiya i Klassifikatsiya Pochv Azii" Moscow, Izd. Nauka, 1965 Published for Dept. of Agr. and NSF *Its* Cat. No. 5270
(TT-68-50439) Copyright. Avail: CFSTI

Soil data for dry and tropical regions of Asia are presented with emphasis on soil geochronology and geomorphology. Some comparisons are made with soils of other continents. For individual titles, see N69-23897 through N69-23921.

N69-23897# Israel Program for Scientific Translations, Ltd., Jerusalem.
CLASSIFICATION OF DESERT SOILS IN THE SUB-BOREAL BELT
E. V. Lobova *In its* Geography and Classification of Soils of Asia 1968 p 1–33 refs (See N69-23896 12-13)
Copyright. Avail: CFSTI

The desert soils of the Asian territory of the USSR between the Caspian Sea and the mouth of the Yellow River are classified by a genetically based separation between sierozem and desert soils. Differences in soil properties are attributed to bioclimatical influences, genetic features, salinity, and development history. This classification is closely related to vegetation and agricultural utilization of the soils. G.G.

N69-23898# Israel Program for Scientific Translations, Ltd., Jerusalem.

IRRIGATED SOILS OF CENTRAL ASIA

B. V. Gorbunov *In its* Geography and Classification of Soils of Asia 1968 p 34–45 refs (See N69-23896 12-13)

Copyright. Avail: CFSTI

Irrigated oases in the Soviet Republics of Central Asia lie in wide river valleys, intermontane basins, and on sloping piedmont plains and exceed 60,000 km^2. The additional moisture intake of irrigated soils resulted in intensive eluvial processes and consequently chlorides and sulfates of sodium, magnesium, and calcium diminished. Organic matter, nitrogen, phosphoric acid, and mobile phosphates accumulated because of the more intense biological activity in these soils and the systematic use of mineral and organic fertilizers. The degree of eluviation determined the soil devision in subgroups. G.G.

N69-23899# Israel Program for Scientific Translations, Ltd., Jerusalem.

CLASSIFICATION, VERTICAL ZONALITY AND PROVINCIAL CHARACTERISTICS OF SOILS IN THE KIRGHIZ SSR

A. M. Mamytov *In its* Geography and Classification of Soils of Asia 1968 p 46–58 refs (See N69-23896 12-13)

Copyright. Avail: CFSTI

From the standpoint of classification, the soils of Kirghizia belong to two major groups: (1) soils of intermontane depressions and syrt uplands; and (2) soils of mountain slopes. Intrazonal soils are treated separately. Within the group of soils in depressions the following may be distinguished: (1) soils of semi-closed intermontane depressions; (2) soils of closed intermontane depressions; and (3) soils of syrt plains (uplands). Among the soils of closed intermontane depressions there are soils of low, moderately-high (transitional) and high-lying depressions. In some respects, the soils of intermontane depressions may be compared with soils on plains within latitudinal zones. However, mountain conditions exert a strong influence upon soil development. This grouping of the soils of Kirghizia is tentative, and suitable for general soil maps of the mountain regions of the USSR. Author

N69-23900# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE SOILS OF IRAN

M. L. Dewan *In its* Geography and Classification of Soils of Asia 1968 p 59–65 refs (See N69-23896 12-13)

Copyright. Avail: CFSTI

A soil map of Iran was compiled from field observations in the following four principle regions: (1) the V shaped mountain ranges; (2) the territory inside this V, consisting of a plateau with low mountains gradually changing into desert; (3) the low lying plain; and (4) the shoreland of the Caspian Sea below ocean level. Soils are grouped according to agricultural criteria and areas used for growing various crops. Iranian "chestnut" colored soils contain 3 to 4% humus, possess a neutral reaction in the upper layers, and show the appearance of carbonates at a depth of 30 to 40 cm. G.G.

N69-23901# Israel Program for Scientific Translations, Ltd., Jerusalem.

DATA ON THE SOILS OF AFGHANISTAN

V. Subramanian et al. *In its* Geography and Classification of Soils of Asia 1968 p 66–70 (See N69-23896 12-13)

Copyright. Avail: CFSTI

This soil survey for Afghanistan contains information about sierozems and other soils. Afghanistan sierozems differ from those found in the USSR by the presence of a compacted horizon of reddish color and by the different character of its carbonates. G.G.

N69-23902# Israel Program for Scientific Translations, Ltd., Jerusalem.

ARID SOILS OF THE NEAR EAST

W. J. Van Liere *In its* Geography and Classification of Soils of Asia 1968 p 71–75 refs (See N69-23896 12-13)

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A general survey of the soils of Syria is presented that includes their agricultural utilization. In the mountainous regions are soils comparable to the cinnamon-leached and brown forest soils of the USSR; the steppe zone region contains semisavanna characteristics and in the desert zone occur stony, gypseous, and alluvial parent materials. A number of soils poses a high carbonate content and salinity. G.G.

N69-23903# Israel Program for Scientific Translations, Ltd., Jerusalem.

COMPARATIVE ANALYSIS OF THE CYCLE OF ASH ELEMENTS AND NITROGEN IN SOME DESERT SOILS OF ASIA

L. E. Rodin et al. *In its* Geography and Classification of Soils of Asia 1968 p 76–102 refs (See N69-23896)

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The biological cycle of ash elements and nitrogen in the soil plant systems of sierozem and desert soils of Syria and USSR are studied. Types of biological cycles are established for desert and semi-desert soils as well as ratios of chemical elements in soils and vegetable bulk. A comparison between sub-boreal and zones and subtropical arid zones shows that the latter possess a stronger red color caused by iron migration along the soil profile in addition to a higher carbonate content in the lower soil stratum. G.G.

N69-23904# Israel Program for Scientific Translations, Ltd., Jerusalem.

CINNAMON SOILS IN THE WESTERN PART OF THE ZERAVSHAN RANGE

M. A. Abdulaev *In its* Geography and Classification of Soils of Asia 1968 p 103–110 refs (See N69-23896 12-13)

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Characterized are the cinnamon soils of mountainous regions in southern Eurasia that are mainly found under dry forests and scrub steppes. The cinnamon dry-steppe soils are similar to the chestnut soils of Iran, while the forest soils resemble the brown soils of Iran. Dry steppe cinnamon soils show an accumulation of clay in mid-profile; they contain hydromica clay minerals and kaolinite accumulations. G.G.

N69-23905# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE CINNAMON DRY-STEPPE SOILS OF THE KOPET DAG

M. P. Aranbaev *In its* Geography and Classification of Soils of Asia 1968 p 111–123 refs (See N69-23896 12-13)

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The cinnamon dry-steppe mountain soils of Turkmenia follow vertically upon dark zierozem, cover terrain at 1300–3000 m elevation, and include as substrates typical carbonate and leached cinnamon soils with intrazonal distribution. Geobotanical and pedological data show analogues to the cinnamon steppe soils of Central Anatolia. G.G.

N69-23906# Israel Program for Scientific Translations, Ltd., Jerusalem.

EVOLUTION OF SOILS IN THE ANCIENT OASES OF THE DESERT ZONE

M. G. Konobeeva *In its* Geography and Classification of Soils of Asia 1968 p 124–131 refs (See N69-23896 12-13)
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Archeological data are used to examine desert transformation of U.S.S.R. soils on alluvial deposits irrigated in the past. The youngest soils appear 100 years after irrigation stopped while the more ancient soils are over 500 to 600 years old. The secondary salinity at the surface of young desert soils of gray-brown type in ancient oasis is of purely biogenous character with an accumulation of sodium. G.G.

N69-23907# Israel Program for Scientific Translations, Ltd., Jerusalem.
SEROZEM SOILS ON THE PIEDMONT PLAINS OF NORTHERN TIEN SHAN
L. A. Assing *In its* Geography and Classification of Soils of Asia 1968 p 132–140 refs (See N69-23896 12-13)
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The low carbonate sierozem soils of the piedmont plains of Kazakhstan contain about 1.6 to 2.5% of humus in the upper horizon with a rapid decrease of humus content with depth. They contain also a higher content of hydromicas and other mica minerals within fine fractions than sierozems in the southern regions of Kazakhstan. The widespread sierozem soils on the piedmont plains developed under the influence of ground moistening. G.G.

N69-23908# Israel Program for Scientific Translations, Ltd., Jerusalem.
PECULIARITIES OF HUMUS FORMATION IN THE PRINCIPAL SOILS OF UZBEKISTAN
N. T. Murav'eva *In its* Geography and Classification of Soils of Asia 1968 p 141–152 refs (See N69-23896 12-13)
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Studied were plant residue decomposition rates and characteristics of humus formation in light gray, typical and dark gray serozems, cinnamon soils, and meadow soils of Uzbekistan. Largest reserves in humus were found in cinnamon leached soils; in light gray and typical serozem humus reserves were at a minimum due to constant plowing. The distribution of humus in depth correlated with the content of root material. G.G.

N69-23909# Israel Program for Scientific Translations, Ltd., Jerusalem.
MICROELEMENTS IN DESERT SOILS AND SEROZEMS OF UZBEKISTAN
M. A. Rish *In its* Geography and Classification of Soils of Asia 1968 p 153–167 refs (See N69-23896 12-13)
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The effects of vegetation and soil-climatic factors on the microelement content were studied in desert and semidesert soils of Uzbekistan pastures. Microelement migration characteristics were determined and correlated with regions where endemic livestock diseases occurred as results of macro- and microelement intake. Hydromorphous areas, where an increased molybdenum content and a moderate deficit of copper in plants were associated with sulfate salinity, constituted biogeochemical copper deficiencies in sheep, goats, and cattle; this was manifested by zootic ataxia, hepatitis of newborn, depigmentation of wool, etc. Sierozem and desert soils of the automorphous regions showed a high coefficient of enrichment for zinc and boron and thus a shrubby vegetation with a low content of iodine. In these areas, domestic animals suffered from goiter, disturbance of reproductive functions, and other symptoms of iodine deficiency. G.G.

N69-23910# Israel Program for Scientific Translations, Ltd., Jerusalem.
COALESCENT SOILS OF THE VOLGA-AKHTUBA FLOODPLAIN, AS ANALOGUE OF BLACK COALESCENT SOILS IN THE TROPICS AND SUBTROPICS
E. A. Kornblyum et al *In its* Geography and Classification of Soils of Asia 1968 p 168–184 refs (See N69-23896 12-13)
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Briefly reviewed are various studies on coalescent black soils in the USSR, their genesis and ecological characteristics, and the probable formation mechanisms. An analog is drawn between black coalescent soils of the tropics and subtropics with floodplain meadow soils of the Volga desert-steppe floodplain. Despite their striking genetic similarity, the soils are divided into tropical, subtropical, and warm-temperate global groups of soil formation. G.G.

N69-23911# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE SOIL MAP OF INDIA
S. P. Raichowdri *In its* Geography and Classification of Soils of Asia 1968 p 185-186 (See N69-23896 12-13)
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The soil map of India is defined and compared with soil classifications for the USSR. Indian desert soils of the subtropical class differ from those in the USSR by their strong sand admixtures. The gray and brown soils are light textured and thin with a lower humus content than their USSR counterparts. G.G.

N69-23912# Israel Program for Scientific Translations, Ltd., Jerusalem.
BROWN SUBARID TROPICAL SOILS OF WEST AFRICA
R. Maignien *In its* Geography and Classification of Soils of Asia 1968 p 187-193 (See N69-23896 12-13)
Copyright. Avail: CFSTI

This group of tropical brown subarid soils is characterized by an AC profile and by deep penetration of organic matter along the profile. Subgroups constitute brown soils as well as red-brown soils. The former are thin and contain a considerable amount of organic matter; their amount of free iron reaches 70 to 75% of the total iron content. With deterioration of natural drainage, the sandy brown soils change into hydromorphous soils with spots. Red-brown soils have a much thicker stratum with a high proportion of free iron (80 to 85% of total) and a C/N ratio of 8; their bases are partly leached out. Subarid brown tropical soils differ from subarid soils of temperate latitudes in iron migration along soil profiles and little accumulation of salts. G.G.

N69-23913# Israel Program for Scientific Translations, Ltd., Jerusalem.
GENESIS AND CLASSIFICATION OF PADDY SOILS
R. Dudal *In its* Geography and Classification of Soils of Asia 1968 p 194-197 (See N69-23896 12-13)
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Changes in the properties of flooded soils of rice paddies constitute: (1) a low pH value; (2) the presence of organic matter; (3) the translocation of iron and magnesium compounds; and (4) the formation of a plow sole from repeated muddying and pulverizing of the soil material. The paddy soils develop more readily on acid parent material than on basic material. G.G.

N69-23914# Israel Program for Scientific Translations, Ltd., Jerusalem.
MAIN SOILS OF THE HUMID TROPICS OF BRAZIL

M. Camargo *In its* Geography and Classification of Soils of Asia 1968 p 198-200 (See N69-23896 12-13)
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The present paper deals chiefly with soils on well-drained terrain in tropical regions of Brazil. On the strength of soil surveys in Brazil, several major soil classes have been singled out. At the highest level of classification, the soils in these regions may be subdivided into two comprehensive categories: soils with "argilic" textural hor. B, and soils with "oxid" hor B–latosols. Soils with structural metamorphic hor. B, or "cambic horizon," are of no great importance; they occur only on high mountain ranges, with mesothermal climatic conditions. The following outline includes all the main soils which have actually been established, and constitutes the latest attempt as classifying the soils at a high taxonomic level. Available data enable us to draw up a scheme of classification of the soils in the humid tropics of Brazil. Author

N69-23915# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE SOILS OF CEYLON
K. R. Panabokke *In its* Geography and Classification of Soils of Asia 1968 p 201-205 (See N69-23896 12-13)
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Nearly nine-tenths of the island of Ceylon consists of crystalline rocks of Archean age, forming a complex of granite, gneiss and schist. A series of highly metamorphosed rocks (khondalite) covers such granite, gneiss and schist. The Vidjayan series consists of a group of biotite gneiss, biotite granite and schist. The island also has widespread melanocratic equigranular rocks, characterized by hypersthene and described as "charmockite" in Ceylon and Southern India. Post-Tertiary products of erosion, probably formed by the destruction of surfaces peneplaned during the Pleistocene period, cover the compact rocks in the northwestern part of the island. The thickness of these deposits increases toward the northwestern seashore. Early Miocene limestone forms the northern peninsula of Ceylon and extends for some distance along the northwestern coast of the island. Present-day marine sand covers most of the shore. Alluvial deposits of varying thickness occur on plains subject to floods, along the banks of rivers and streams within lowland districts. Author

N69-23916# Israel Program for Scientific Translations, Ltd., Jerusalem.
SOIL MAPS OF MALAYA
W. P. Panton *In its* Geography and Classification of Soils of Asia 1968 p 206-212 refs (See N69-23896 12-13)
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A history of soil survey in Malaya is outlined with emphasis on geological mapping. Soil groups are defined through genetics and their level of fertility. Soils under mangroves, which seem infertile according to their diagnostic features, give good crop yields because: (1) the roots draw nutrients out of unweathered parent materials; (2) the favorable air moisture regime; and (3) the removal of infertile topsoil by erosion. The least fertile soils are those on alluvial deposits. G.G.

N69-23917# Israel Program for Scientific Translations, Ltd., Jerusalem.
SOILS OF BURMA
I. I. Karmanov *In its* Geography and Classification of Soils of Asia 1968 p p213-236 (See N69-23896 12-13)
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Studied were the hydrophysical properties of the following agricultural soils of Burma: (1) the light colored and dark meadow soils; (2) the red-brown soils of dry savannas; (3) the dark coalescent soils of dry savannas; and (4) the reddish-cinnamon soils of dry tropical forests and secondary savannas. Determined were volumetric weight, density and moisture content, water permeability, and field moisture capacity. It was found that dark meadow soils and dark coalescent soils, which have a weak alkaline reaction, do not change perceptibly with rice agriculture. G.G.

N69-23918# Israel Program for Scientific Translations, Ltd., Jerusalem.
FLOODPLAIN SOILS OF UPPER GUINEA
N. V. Kimberg *In its* Geography and Classification of Soils of Asia 1968 p 237-242 refs (See N69-23896 12-13)
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The floodplain soils along the Niger River have a weak acid reaction and show some degree of nonsaturation. Hydrogen and aluminum appear within the absorption complex. Soils are ferruginated and rich in sesquioxides; soil content differences in Upper Guinea correlate with lithologico-geomorphological and hydrological conditions. G.G.

N69-23919# Israel Program for Scientific Translations, Ltd., Jerusalem.
GENESIS OF "DEGRADED" SOILS ON PADDIES IN THE TROPICS
B. G. Rosanov et al *In its* Geography and Classification of Soils of Asia 1968 p 243-248 refs (See N69-23896 12-13)
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Degraded paddy soils in Burma differ from usual paddy soils by lighter texture and the absence of any cracking during the dry season. Their texture is usually sandy-loamy or silty-loamy in the upper profile. These soils are very porous and because of their limited moisture capacity yield only 10 to 12 q/ha rice. Chemical analysis establishes a marked prevalence of silicic acid and a definite amount of bases throughout the soil stratum with perceptible downward shifting of sesquioxides beneath the tillage horizon. G.G.

N69-23920# Israel Program for Scientific Translations, Ltd., Jerusalem.
DATA ON THE SOILS OF THE SOUTHWESTERN PART OF THE ARABIAN PENINSULA
L. R. Asmaev *In its* Geography and Classification of Soils of Asia 1968 p 249-257 refs (See N69-23896 12-13)
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The soil map of Yemen has the characteristics of a tropical semidesert. The more mature soils show: (1) a low content of humus, but its deep penetration along the profile; (2) a feeble weathering and soil formation poor in carbonates; and (3) an argillization in mid-profile. Mountain soils as well as soils on plains are similar and differ only where a more humid climate exists. G.G.

N69-23921# Israel Program for Scientific Translations, Ltd., Jerusalem.
GENERAL REVIEW OF THE PROBLEMS OF SOIL CLASSIFICATION IN CENTRAL AND SOUTHERN ASIA
E. V. Lobova *In its* Geography and Classification of Soils of Asia 1968 p 258-266 refs (See N69-23896 12-13)
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This review contains diagnostic criteria, soil types, and humus composition aspects of soil classifications. The genetic nature of the Asian soils, as related to zonal hydrothermal conditions, has been generally elucidated and the considerable role played by soil-forming material has been outlined. The main subclasses of tropical soils have been grouped according to their diagnostic criteria and are shown in table form. G.G.

N69-23959*# Communications and Systems, Inc., Falls Church, Va.
PROCEEDINGS OF THE GEOS PROGRAM REVIEW MEETING. VOLUME 1: GEOS-1 OPERATIONS AND PLANS FOR GEOS-B
Mar. 1968 238 p Meeting held at Washington, 12–14 Dec. 1967
(Contract NASw-1503)
(NASA-CR-100679) Avail: CFSTI CSCL 08E

This volume contains descriptions of the GEOS 1 (Explorer 29) satellite, its operations, and the participating networks. In addition, the GEOS B satellite is described, and plans for its operation are investigated. For GEOS 1, details are presented on spacecraft performance, participating tracking stations, the Mutual Visibility Flash Schedule system, the status of the Goddard Range and Range Rate data, and data processing operations. The articles on GEOS B cover launch window constraints, tracking station locations, participation of the Wallops station C band radar, expected contributions to studies of the Smithsonian Astrophysical Observatory, and the experimental plans of the various agencies for the satellite. K.W.

N69-23960*# Communications and Systems, Inc., Falls Church, Va.
PROCEEDINGS OF THE GEOS PROGRAM REVIEW MEETING. VOLUME 2: GEOMETRIC AND GRAVIMETRIC INVESTIGATIONS WITH GEOS-1
Mar. 1968 124 p refs Meeting held at Washington, 12–14 Dec. 1967
(Contract NASw-1503)
(NASA-CR-100675) Avail: CFSTI CSCL 08E

Eight technical papers are presented which describe geometric and gravimetric studies conducted by different investigators using GEOS 1 data. Specifically, the studies cover: (1) tracking data evaluation for tesseral harmonics of the earth's gravitational field; (2) use of the satellite data for establishing a primary network, a densification network, and a set of scientific reference stations for geodetic purposes; (3) Department of Defense experiments in connection with GEOS 1 and GEOS B (Doppler, Sequential Collation of Range, BC-4 cameras, and PC-1000 cameras); (4) establishment of a global 43-station network of satellite triangulation, and satellite tracking, by the Coast and Geodetic Survey; (5) overall contributions of GEOS 1 to geodetic science; (6) interstation connections from GEOS 1 optical beacon observations; and (7) use of tracking data to determine station locations in a geocentric Cartesian coordinate system. K.W.

N69-23971*# RCA Service Co., Inc., Seabrook, Md.
REFRACTION CORRECTION INTERCOMPARISONS. GEODETIC INVESTIGATIONS AT GSFC
Horace C. Parker *In* Commun. and Systems, Inc. Proc. of the GEOS Program Rev. Meeting, Vol. 3 Feb. 1968 p 371–388 (See N69-23961 12-07)
(Contract NAS5-9756)
Avail: CFSTI CSCL 04A

The GEOS geodetic tracking systems do not have a standard set of refraction formulas. Different groups using the same data employ different mathematical models of the atmosphere or different approximations to the same model. The primary purpose of this paper is to compute values from the different formulas so that the differences can be determined. Range and range rate refraction error values versus the elevation angles were computed from formulas obtained from the following GSFC programs: (1) the Differential Correction program; (2) the Freeman recommendations; (3) the NONAME program; (4) the Laser system by both the GSFC developed program and the SAO developed program; and (5) the GDAP program. The following assumptions were made to all calculations in this preliminary study: (1) the tropospheric surface index of refraction $= 282 \times 10^{-6}$; (2) the ionosphere index of refraction typical for 2GHZ $= 3.941 \times 10^{-6}$; (3) the height of the F_2 layer of the ionosphere = 400 km; and (4) the height of the satellite above the surface of the earth = 1333 km. This particular set of values allows for comparison with those equations, where the atmosphere models are a constant. Author

N69-24062# Blume (John A.) and Associates Research Div., San Francisco, Calif.
STOCHASTIC SIMULATION OF SITE RESPONSE TO EARTHQUAKES AND UNDERGROUND EXPLOSIONS, PHASE 1
Nov. 1968 60 p refs
(Contract AT(26-1)-99
(JAB-99-39) Avail: CFSTI

Results are reported for the initial phase of study on ground motion prediction and simulation. The auto-correlation functions and the power spectral density functions were obtained for a total of fifteen ground motion records. It was proposed to use these functions to characterize ground motions and to form a basis for determining the equivalent ground-layer filter for the desirable stochastic model. Linear filters to represent the ground transfer characteristics of the seismic stations were studied. Single-degree-of-freedom solutions for each of the fifteen seismic stations were obtained, expressed in terms of the predominant frequencies and the effective damping for the sites of each station. Author (NSA)

N69-24078*# Volt Information Sciences, Inc., Washington, D. C.
BOUNDARY OF TRAPPED ELECTRONS WITH $E \geq 280$ KEV AND DISPOSITION OF CURRENT ELECTRO JETS IN THE IONOSPHERE
R. G. Afonina et al Greenbelt, Md. NASA. Goddard Space Flight Center 6 May 1968 6 p refs Transl. into ENGLISH from Kosmich. Issled., Akad. Nauk SSSR (Moscow), v. 7, no. 2, 1969 p 312-314
(Contract NAS5-12487)
(NASA-CR-100755; ST-PF-GM-AI-10832) Avail: CFSTI CSCL 04A

This note consists mainly in discussion and interpretation of the results of observations by the 1963 satellite 38-C. The whole paper is principally based upon the previous publications by Dr. D.J. Williams *et al*, and on the corrected geomagnetic latitudes of the equivalent linear current at ionospheric heights and of the trapping region of electrons with $E \geq 280$ kev. Author

N69-24095# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
HIGHLY IRREGULAR ARTIFICIAL PLASMA CLOUDS IN THE AURORAL ZONE
G. Haerendel, R. Luest, E. Rieger, and H. Voelk Jan. 1969 20 p refs
(MPI-PAE-EXTRATERR-21) Avail: CFSTI

A method of deriving the ionospheric electric field from the motion of artificially injected barium ion clouds is described. An impedance probe was used for measuring the electron density in the neighborhood of a rocket in the auroral zone to obtain information about the ionospheric conductivities. Measurements of the ionospheric electric field were made using artificial plasma clouds and solving an equation of motion. B.G.D.

N69-24098# Illinois Univ., Urbana. Aeronomy Lab.
GRAVITY WAVES IN A VISCOUS ATMOSPHERE
K. D. Shere and S. A. Bowhill 15 Jan. 1969 117 p refs /*ts* Aeronomy Rept. No. 31
(Grant NSF GA-888)
Avail: Issuing Activity

The propagation of gravity waves in an atmosphere with horizontal background winds was considered. The atmosphere was taken to be a non-conductive, compressible fluid which is initially isothermal. All processes were taken to be adiabatic and both the curvature and the rotation of the earth were neglected. Only two space variables were considered. The linearized equations of motion were derived and solved for four models. Author

N69-24099*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AIRBORNE MULTIFREQUENCY MICROWAVE RADIOMETRIC SENSING OF AN EXPOSED VOLCANIC PROVINCE
John C. Blinn, III, Peter Chapman, (Nevada Univ.) and Jack Quade (Nevada Univ.) 15 Oct. 1968 40 p refs
(Contract NAS7-100)
(NASA-CR-100756, JPL-TM-33-405) Copyright. Avail: CFSTI CSCL 08F

An empirical study was conducted, using airborne and ground based sensors, to search for correlations between multispectral microwave brightness temperatures and geologic parameters. The test site, in the vicinity of Mt. Lassen, Calif., was chosen because of its simple topography, large distinct areas of homogeneous composition, roughness characteristics, and lack of vegetation. Radiometers, operating at 9.3, 15.8, 22.2, and 34.0 GHz, were flown over preselected flight lines four times per flight to collect data. Results of the ground truth studies and analysis of the aircraft overflights show a distinction between cinder and lava, two chemically similar materials with different surface characteristics. Results from an area of cinder layered over lava show a distinctive response, which may be related to cinder thickness. An improved experiment, which uses more temperature probes, geologic cross sections, a ground-based microwave radiometer, and other refinements, is recommended. Author

N69-24124# Instituto Geografico y Catastral, Madrid (Spain) Geomagnetic and Aeronomy Div.
MAGNETIC ANOMALIES OF THE IBERIAN PENINSULA, 1960 [ANOMALIAS MAGNETICAS DE LA PENINSULA IBERICA, EPOCA 1960,0]
Jose Ruiz Lopez 3 Feb. 1967 33 p In SPANISH
Avail: CFSTI

Maps of Spain and Portugal based on surveys carried out between 1954 and 1959 are presented. The isoclinic lines and lines of equal horizontal and vertical geomagnetic intensity are analysed. A correlation between the anomalous zones of vertical intensity and the mountainous regions is also discussed. ESRO

N69-24140# Ionosphären-Institut Breisach (West Germany).
IONOSPHERE DATA, ABSORPTION MEASUREMENTS: FREIBURG, URSI CODE 131, JULY–DECEMBER 1968 [IONOSPHAEREN-DATEN, ABSORPTIONS-MESSUNGEN: FREIBURG, URSI-CODE 131, JULI–DEZEMBER 1968]
1968 13 p In GERMAN
Avail: CFSTI

Tabulated absorption losses as determined by daily echo amplitude soundings are presented. The measurements were performed at eight different frequencies between 1.725 and 5.80 MHz. Transl. by K.W.

N69-24151# Israel Program for Scientific Translations, Ltd., Jerusalem.
GENESIS OF THE SOILS OF WESTERN SIBERIA [GENEZIS POCHV ZAPADNOI SIBIRI]
R. V. Kovalev, ed. 1968 177 p refs Translated into ENGLISH from the Publ. Akad. Nauk SSSR, Sibirskoe Otd., Tr. Biol. Inst. no. 12 (Novosibirsk), 1964 Prepared for US Dept. of Agr. and NSF *Its* Cat. No. 5269
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CONTENTS:

1. GENESIS OF SECONDARILY PODOZOLIC SOILS IN THE VASYUGAN AREA I. M. Gadzhiev p 1–10 refs (See N69-24152 12-13)
2. PECULARITIES OF SOIL FORMATION IN STEPPE BASINS OF THE SOUTHEASTERN ALTAI V. I. Volkovintsev p 11–21 refs (See N69-24153 12-13)
3. MOUNTAIN MEADOW-STEPPE SOILS OF GORNO-ALTAI AND THE LESSER CAUCASUS F. K. Ragim-Zade p 22–29 refs (See N69-24154 12-13)
4. FEATURES OF SOILS IN THE DRAINAGE AREA OF THE ISHA RIVER V. A. Khmelev p 30–43 refs (See N69-24155 12-13)
5. SOILS OF STONE-PINE-LARCH FORESTS OF THE CHULYSHMAN RANGE S. R. Kovaleva p 44–51 refs (See N69-24156 12-13)
6. DISTRIBUTION OF MOBIL MANGANESE IN SOILS OF THE GORNO-ALTAI M. A. Malgin p 52–62 refs (See N69-24157 12-13)
7. THE NATURE OF HUMUS IN THE PRINCIPAL SOILS OF THE SUBTAIGA ZONE AND THE SUBZONE OF THE SOUTHERN TAIGA IN THE WEST-SIBERIAN LOWLAND M. G. Shushueva p 63–71 refs (See N69-24158 12-13)
8. NITROGEN-FIXING PROPERTY AND DISTRIBUTION OF OLIGONITROPHILOUS ACTINOMYCETES IN GORNO-ALTAI SOILS I. L. Kievenskaya p 72–78 refs (See N69-24159 12-04)
9. INTENSITY OF AEROBIC DESTRUCTION OF CELLULOSE IN RELATION TO THE NITROGEN COMPOUNDS IN GORNO-ALTAI SOILS N. N. Naplekova p 79–84 refs (See N69-24160 02-04)
10. EXPERIMENT WITH MINERAL FERTILIZERS ON GRAY FOREST SOILS IN THE NOVOSIBIRSK REGION V. P. Shapovalov et al p 85–91 refs (See N69-24161 12-04)
11. SOME REGULARITIES OF SALT ACCUMULATION IN SOILS OF THE KULUNDA LOWLAND S. N. Selyakov p 92–96 refs (See N69-24162 12-13)
12. INFLUENCE OF THE AMOUNT OF PRECIPITATION UPON THE SALT CONTENT OF SOLONETS SOILS, PLOWED WITHOUT MOLDBOARD, IN THE BARABA LOWLAND T. N. Ryabova p 97–101 refs (See N69-24163 12-13)
13. ACCUMULATION OF SODA IN GROUNDWATER P. S. Panin p 102-110 refs (See N69-24164 12-13)
14. DEVELOPMENT OF EROSION PROCESSES IN THE NOVOSIBIRSK REGION A. D. Orlov p 111/116 refs (See N69-24165 12-13)
15. MOISTURE REGIME OF SOLONETS SOILS IN THE BARABA LOWLAND AFTER RECLAMATION A. P. Trubetskaya p 117–120 refs (See N69-24166 12-13)
16. AGROPHYSICAL PROPERTIES OF THE MAIN TYPES OF SOIL IN THE NOVOSIBIRSK REGION V. P. Panfilov p 121–173 refs (See N69-24167 12-13)

N69-24152# Israel Program for Scientific Translations, Ltd., Jerusalem.
GENESIS OF SECONDARILY PODZOLIC SOILS IN THE VASYUGAN AREA
I. M. Gadzhiev *In its* Genesis of the Soils of Western Sibera 1968 p 1–10 refs (See N69-24151 12-13)
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Samples of the two types of soils found in the Vasyugan River drainage area were analyzed, beginning with the meadow-marshy soils on terrain with relatively poor drainage and ending with secondarily podzolic soils which are characterized by a second

humus horizon. The latter type is found on riverine, well-drained terrain, and detailed data are presented on its humus content, texture, and total chemical composition. These data show that the degree of degradation depends directly upon the degree of drainage. It was therefore concluded that the secondarily podzolic soils were formed through the evolution of meadow, meadow-marshy, and possibly marshy soils, with gradual improvement in the drainage of this area. A.C.R.

N69-24153# Israel Program for Scientific Translations, Ltd., Jerusalem.
PECULIARITIES OF SOIL FORMATION IN STEPPE BASINS OF THE SOUTHEASTERN ALTAI
V. I. Volkovintser *In its* Genesis of the Soils of Western Siberia 1968 p 11–21 refs (See N69-24151 12-13)
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The genetic and productive properties of the chestnut soils developing in the high mountain steppe basins and valleys are elucidated. The Altai region is situated at the junction of two widely differing climatic regions at the center of the Asian continent, which accounts for the unusual association, within a comparatively limited territory, of mountain-taiga landscapes with steppe features of the Mongolian type. The topography, geomorphology, and climatology of the region are discussed, as well as the general nature of the vegetation and soil composition. Detailed analysis of the chestnut soils found in the desert and dry steppes indicated that the geographical distribution of subtypes is generally subject to contrasts in climate, from less arid to severely dry conditions. It was concluded that although the area of plowland is still very limited within the dry, high mountain basins of the Altai, extensive areas of virgin land exist, which are as yet of low productivity but are suitable for agricultural reclamation. A.C.R.

N69-24154# Israel Program for Scientific Translations, Ltd., Jerusalem.
MOUNTAIN MEADOW-STEPPE SOILS OF GORNO-ALTAI AND OF THE LESSER CAUCASUS
F. K. Regim-Zade *In its* Genesis of the Soils of Western Siberia 1968 p 22–29 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

A comparative study was made of the physicochemical properties, the chemical and mineralogical composition, and the genetic and agricultural peculiarities of the mountain meadow-steppe soils of the two regions. A brief description of the geomorphology and climatology is also given of the Gorno-Altai region, as related to soil formation, since little had previously been published. Comparison of soils from the regions yielded the following results: (1) Despite the different geographical situation of the mountain systems and the striking disparity in the growing season length and climatology, the development of meadow-steppe soils appears to be very similar. (2) The soils of the two regions also have many morphological features in common, and their chemical composition and physicochemical properties are also of the same type. A.C.R.

N69-24155# Israel Program for Scientific Translations, Ltd., Jerusalem.
FEATURES OF SOILS IN THE DRAINAGE AREA OF THE ISHA RIVER
V. A. Khmelev *In its* Genesis of the Soils of Western Siberia 1968 p 30–43 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

Characteristics of soil formation within the northeastern part of the Gorno-Altai region are discussed, as related to the geomorphology climatology, and vegetation of the area. Although podzolic gray forest soils, mostly of the sod-podzolic type, were prevalent, several other kinds of mountain and meadow soils were found. Detailed analyses were made of the sod-podzolic soils, and tables are included on their specific composition and physicochemical properties. It was concluded from the analyses that the drainage area of the Isha River has excellent prospects for agricultural reclamation, although the predominant sod-podzolic soils require liming. A.C.R.

N69-24156# Israel Program for Scientific Translations, Ltd., Jerusalem.
SOILS OF STONE-PINE-ARCH FORESTS OF THE CHULYRHMAN RANGE
S. R. Kovalena *In its* Genesis of the Soils of Western Siberia 1968 p 44–51 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

Soils in the northeastern part of the Gorno-Altai region were surveyed using the method of itineraries. Soil cuts were performed on slopes of varying climatological exposure with different kinds of forest vegetation, and it was found that mountain-taiga soils prevail in this region. Specific data are presented on the development, profile structure, morphological influences, texture, and chemical composition of these soils. Analyses of the samples resulted in the designation of the soils as of mountain-taiga, raw-humus, cinnamon acid type, and their possible silvicultural properties are stressed. A.C.R.

N69-24157# Israel Program for Scientific Translations, Ltd., Jerusalem.
DISTRIBUTION OF MOBILE MANGANESE IN SOILS OF THE GORNO-ALTAI
M. A. Malgin *In its* Genesis of the Soils of Western Siberia 1968 p 52–62 (See N69-24151 12-13)
Copyright. Avail: CFSTI

In an effort to determine the zones and soils in which manganese fertilizers would be the most effective, the content of, mobile manganese in the upper horizons of Gorno-Altai soils, a region known, for its wide range in the amount of such material either between the soil types or within a single type, was analyzed. Data are presented on the geographical and mountain-steppe profile distributions for mobile manganese. It was concluded that differences of soils formation, vegetation, cultivation, and other conditions determine varying accumulation of mobile forms of manganese compounds in the local soil. The varying mountain-steppe profiles are then classified as to the need for artificial manganese fertilization of the soil. A.C.R.

N69-24158# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE NATURE OF HUMUS IN THE PRINCIPAL SOILS OF THE SUBTAIGA ZONE AND THE SUBZONE OF THE SOUTHERN TAIGA IN THE WEST-SIBERIAN LOWLAND
M. G. Shushueva *In its* Genesis of the Soils of Western Siberia 1968 p 63–71 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

In order to better understand the genetic character of the soils in the subtaiga and southern taiga regions, specific traits of humus composition, as well as the nature of humic acids, were determined. It was found that the character of humus in meadow soils and chernozem is expressed by the very high ratio between the carbon content of humic acids and that of fulvic acids and the complex structure of the humic acid molecule. The sod-podzolic and gray forest soils are similar to chernozem as related to the ratio between principal groups of humic substances and colloidal-chemical properties of humic acids. Finally, the composition of humus in secondarily podzolic soils differs according to the degree of podzolization and the noticeability of the second humus horizon. A.C.R.

N69-24162# Israel Program for Scientific Translations, Ltd., Jerusalem.
SOME REGULARITIES OF SALT ACCUMULATION IN SOILS OF THE KULUNDA LOWLAND
S. N. Selyakov *In its* Genesis of the Soils of Western Siberia 1968 p 92-96 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

The formation, migration, metamorphosis, and accumulation of salts in soils and waters, as well as the seasonal dynamics of these compounds, are analyzed. In particular, examination of data on the water salinity in the lowland resulted in determination of various zones in which several types of chemism of lake waters predominate. Soil salinity in the region appears to be due to the contemporary process of continental salt accumulation, and soda salination is widespread. Gypsum and sodium chloride salinity is only local, an observation which correlates with differences in the type of salinity of lake waters. It was concluded that regularities of soil salinity may serve as a guide in solving problems of melioration of saline soils, as well as of commercial exploitation of salts from the major lake of the Kulunda lowland. A.C.R.

N69-24163# Israel Program for Scientific Translations, Ltd., Jerusalem.
INFLUENCE OF THE AMOUNT OF PRECIPITATION UPON THE SALT CONTENT OF SOLONETS SOILS PLOWED WITHOUT MOLDBOARD, IN THE BARABA LOWLAND
T. N. Ryabova *In its* Genesis of the Soils of Western Siberia 1968 p 97-101 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

Medium, columnar, meadow-steppe soils were studied in relation to the dynamics of salts in solonets after plowing without moldboard and with plots using other types of cultivation. It was found that a change takes place in the content of water soluable salts in the soil regardless of the method of tillage and dependent on the amount of precipitation. In addition, deep moldboardless plowing reestablishes salinity during dry periods, but at a slower rate than for shallow plowing. A.C.R.

N69-24164# Israel Program for Scientific Translations, Ltd., Jerusalem.
ACCUMULATION OF SODA IN GROUNDWATER
P. S. Panin *In its* Genesis of the Soils of Western Siberia 1968 p 102-110 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

Data are presented on the problem of soda accumulation in agricultural soil, as exemplified on the sloping piedmont plain of Karabakh, which is located in an arid region. Sampling results indicate that subterranean waters of such areas shift from the foothills toward the lowland, forming a zone of upwelling, and separating into artesian waters and groundwater. The groundwater has a two layer composition; the lower layer moves horizontally, and the upper layer moves vertically downward when precipitation exceeds evaporation and upward when evaporation is greater than precipitation. Artesian waters are weakly mineralized and contain soda among their salts. The highest figures of total alkalinity and of soda are found in the upper horizon of groundwater, an increase which coincides with that of mineralization of subterranean waters up to 10 to 20 g/l mineralization. It was concluded that transformation of subterranean waters and accumulation of soda in groundwater, such as occurs in the region under study, are to a certain extent also typical for other regions situated where evaporation exceeds precipitation. A.C.R.

N69-24165# Israel Program for Scientific Translations, Ltd., Jerusalem.
DEVELOPMENT OF EROSION PROCESSES IN THE NOVOSIBIRSK REGION
A. D. Orlov *In its* Genesis of the Soils of Western Siberia 1968 p 111-116 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

Erosion processes as related to local topography, climatic conditions, texture of soils and parent material, economic activities, and other factors are discussed for the Ob plateau and Salair area. It was established that these processes are of two kinds: gullying, as evidenced on the Ob plateau; and sheet erosion, which prevails in the Salair area. The most eroded soils were loams on southern and western slopes, and soil erosion increases with slope steepness for all types of material. In the Salair area, linear erosion apparently due to neotectonic movements was also noticed. The intensity of gullying on the Ob plateau led to further dissection of the terrain and to stronger erosion. It was therefore concluded that gullying control is of urgent necessity in this area. A.C.R.

N69-24166# Israel Program for Scientific Translations, Ltd., Jerusalem.
MOISTURE REGIME OF SOLONETS SOILS IN THE BARABA LOWLAND AFTER RECLAMATION
A. D. Trubetskaya *In its* Genesis of the Soils of Western Siberia 1968 p 177-120 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

In attempting to develop an effective system of cultivating solonets, their physical properties and moisture regime were studied using three techniques. Analysis of the data indicated that cultivation modifies the physical and moisture properties of this type of soil and considerably improves the provision of water for agricultural crops. Plowing without the use of moldboards proved to be the best method. A.C.R.

N69-24167# Israel Program for Scientific Translations, Ltd., Jerusalem.
AGROPHYSICAL PROPERTIES OF THE MAIN TYPES OF SOIL IN THE NOVOSIBIRSK REGION
V. P. Panfilov *In its* Genesis of the Soils of Western Siberia 1968 p 121-173 refs (See N69-24151 12-13)
Copyright. Avail: CFSTI

Four types of soil found within the Novosibirsk region were analyzed: chernozem; gray forest soil; meadow and marshy soil; and solonets and solonchak. It was found that soil types differ conspicuously in hydrophysical properties and moisture regime, so that discretion should be exercised in use of any measures to improve the productivity of the area. A.C.R.

N69-24173*# Illinois Univ., Urbana. Aeronomy Lab.
ELECTRON DENSITIES IN THE LOWER IONOSPHERE DEDUCED FROM PARTIAL REFLECTION MEASUREMENTS
C. R. Pimst and S. A. Bowhill 15 Dec. 1968 77 p refs *Its* Aeronomy Report no. 29
(Grant NGR-14-005-013)
(NASA-CR-100767) Avail: CFSTI CSCL 04A

The history and underlying theory of the partial reflection experiment is reviewed. An electron density profile is calculated from differential absorption measurements using a collision-frequency model extrapolated from rocket measurements. This profile is in reasonable accord with rocket measurements of electron density. In reviewing the applicability of a partial reflection experiment using high-frequency radiowave pulses, the main limitation was found to be atmospheric noise. Author

N69-24191# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE SIXTH VOYAGE OF R/V "OB" [SHESTOI REIS D/E "OB"]
A. F. Treshnikov, ed. 1968 231 p refs Transl. into ENGLISH from the book "Trudy Sovetskoi Antarkticheskoi Ekspeditsii, vol. 39" Leningrad, Morskoi Transport, 1963 Supported by NSF (TT-68-50311) Avail: CFSTI

CONTENTS:

1. THE SIXTH ANTARCTIC VOYAGE OF THE "OB" V. G. Ledenev p 1–110 (See N69-24192 12-13)
2. BOTTOM SEDIMENTS IN THE AREAS OF THE WEST AND THE LAZAREV ICE SHELVES N. N. Kulikov p 111–130 (See N69-24193 12-13)
3. CURRENT MEASUREMENTS AND CHARACTERISTICS V. G. Ledenev p 131–154 refs (See N69-24194 12-13)
4. TIDAL CURRENTS AT LAZAREV ICE SHELF L. I. Eskin p 155–159 refs (See N69-24195 12-13)
5. ICE CONDITIONS IN THE COASTAL WATERS OF EAST ANTARCTICA BETWEEN 12 AND 95°E V. G. Ledenev et al p 16–173 (See N69-24196 12-13)
6. RESULTS OF HYDROGRAPHIC RESEARCH A. P. Evdokimov p 174–176 refs (See N69-24197 12-13)
7. BIOLOGICAL OBSERVATIONS K. A. Brodskii et al p 177–199 (See N69-24198 12-04)
8. METEOROLOGICAL AND ACTINOMETRIC OBSERVATIONS G. I. Kizno et al p 201–228 (See N69-24199 12-20)

N69-24192# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE SIXTH ANTARCTIC VOYAGE OF THE "OB"
V. G. Ledenev In its The Sixth Voyage of R/V "Ob" 1968 p 1–110 (See N69-24191 12-13)
Avail: CFSTI

The activity log of the OB is briefly summarized. The hydrological work performed during the sixth voyage continued the research of the Soviet Antarctic expedition on the waters of the southern hemisphere washing the shores of Antarctica. Emphasis was placed on studies of waters in the direct vicinity of the shores, especially off the Shackleton, West, Amery, and Lazarev ice shelves. The shore waters were investigated beginning with Mirny and further westward to the Lazarev Ice Shelf. The sea party performed a total of 118 complete hydrological stations. Samples of bottom sediments were taken at 97 stations and plankton sampling in the 0 to 20 m layer was performed at 75 stations. The expedition sounded the depths over a distance of nearly 12,000 miles, made descriptions of the Antarctic coasts, and performed about 10,000 determinations of different chemical characteristics of water in the investigated regions. Tabulated data are presented on results of the observations at the stations. B.P.

N69-24193# Israel Program for Scientific Translations, Ltd., Jerusalem.
BOTTOM SEDIMENTS IN THE AREAS OF THE WEST AND THE LAZAREV ICE SHELVES
N. N. Kulikov *In its* The Sixth Voyage of R/V "Ob" 1968 p 111–130 (See N69-24191 12-13)
Avail: CFSTI

The sea party carried out oceanographic investigations in the Lazarev and the West Ice Shelves in mid-December 1960 and from end of February through first half of March 1961. The principal characteristics of the bottom sediments in these regions as established by primary investigation of the wet samples and preliminary laboratory processing are tabulated. Author

N69-24194# Israel Program for Scientific Translations, Ltd., Jerusalem.
CURRENT MEASUREMENTS AND CHARACTERISTICS
V. G. Ledenev *In its* The Sixth Voyage of R/V "Ob" 1968 p 131–154 refs (See N69-24191 12-13)
Avail: CFSTI

Instrumental current measurements were performed in the Leningrad and Amundsen bays (Enderby Land area) by installation of BPV-2 printing current meters. The data obtained on currents in the Enderby Land area are suitable only for a general characterization of the movement of water in this area. In addition to current measurements with the printing current meters, a continuous surface current recording with the electromagnetic current meter was performed on all legs of the voyage. Information on the installation sites of the EPV-2 current meters and the results of the current measurements are provided. Also tabulated is a general summary of the vectors of surface currents. Author

N69-24195# Israel Program for Scientific Translations, Ltd., Jerusalem.
TIDAL CURRENTS AT LAZAREV ICE SHELF
L. I. Eskin *In its* The Sixth Voyage of R/V "OB" 1968 p 155–159 (See N69-24191 12-13) refs
Avail: CFSTI

Instrumental observations of currents in the Leningrad Bay were continued with the printing current meter. The meters were placed at the given horizons either from the ship when moored by ice anchors to fast ice, or directly from the fast ice. The general scheme of the hydrological stations at which observations were made is represented. The harmonic analysis of observation data of currents in December 1959 enabled isolation of diurnal, semi-diurnal, and quarter-diurnal tidal waves. The results of this analysis are tabulated. The harmonic and nonharmonic constants of the currents and 50 and 150 m horizons are also shown. B.P.

N69-24196# Israel Program for Scientific Translations, Ltd., Jerusalem.
ICE CONDITIONS IN THE COASTAL WATERS OF EAST ANTARCTICA BETWEEN 12° AND 35° E
V. G. Ledenev et al *In its* The Sixth Voyage of R/V "Ob" 1968 p 160-173 (See N69-24191 12-13)
Avail: CFSTI

Shipboard glacial observations commenced on 5 December 1960 upon encounter with the first iceberg, at 51°24'S, 15°58'E. The observations were performed according to the method approved by the Arctic and Antarctic Institute and the results were recorded in the ice log. Nine ice charts were compiled based on these data, describing the ice conditions between 12° and 95°E along the Antarctica coasts. All ice observations and recording of the number of icebergs were performed by members of the sea party. Author

N69-24197# Israel Program for Scientific Translations, Ltd., Jerusalem.
RESULTS OF HYDROGRAPHIC RESEARCH
A. P. Evdokimov *In its* The Sixth Voyage of R/V "OB" 1968 p 174-176 refs (See N69-24191 12-13)
Avail: CFSTI

The processing of the hydrographic investigation results performed during the sixth voyage in the Atlantic and the Indian oceans and off the Antarctic coast included plotting and analyzing of sounding lines along a route of 11,920 miles as follows: (1) Capetown to Lazarev station, 1122 miles; (2) Lazarev station to Mirny, 2778 miles; (3) Mirny to Lazarev station, 2772 miles; (4) Lazarev station to Mirny, 2102 miles; (5) Mirny to Capetown, 2589 miles; and (6) On the hydrologic section (west of the African coast), 557 miles. The plotted route was fixed by 218 coordinate readings as follows: Celestial, 34; Radar, 73; and Visual, 9. Only a relatively small number (16% of the total) of celestial fixes provided referencing for 9544 miles of the route (90% of total).

Visual and radar fixes were largely used when the Ob sailed on near shore sections. The route was plotted on 42 charts, grid charts and a plan. This cartographic base was marked with 3917 depth soundings, and 75 bottom-sediments determinations. The sixth voyage included important bottom relief investigations in the near-shore zone of Antarctica between Mirny and Lazarev station. Detailed hydrographic investigations were performed on the continental shelf off the West Ice Shelf, along the Enderby Land coast and on approaches to Lazarev station in the southern part of the Leningrad Bay. Author

N69-24200*# Michigan Univ., Ann Arbor.
S-047 EXPERIMENT Final Technical Report
[1969] 160 p refs
(Contract NAS9-7457)
(NASA-CR-99628) Avail: CFSTI CSCL 04A

The meteorological importance of refraction angle measurements is discussed, and performance and design specifications are presented for a state-of-the-art stellar refraction star tracker. It is reported that a prototype brassboard instrument was designed and constructed but not completely tested due to cancellation of the proposed mission. M.G.J.

N69-24261# California Univ., Livermore. Lawrence Radiation Lab.
RATE OF EVOLUTION OF THE EARTH'S CRUST
Gary H. Higgins 22 Oct. 1968 23 p refs Presented at the Geol. Soc. of Am. Meeting, Mexico City, 11 Nov. 1968
(Contract W-7405-eng-48)
(UCRL-71187; Conf-681111-1) Avail: CFSTI

A simple mathematical model of the earth was derived to study the rate of melting induced by radioactive decay in a protomantle which is initially of uniform oxide composition. The assumptions were: the protomantle was initially solid; the local temperature was at the local melting point; the radioactivities were initially uniformly distributed; the radioactivities were enriched in the molten protomantle relative to the solid protomantle; molten protomantle material was then removed from the protomantle (migrated to the surface) in times short compared to the age of the earth; the present heat flow is in equilibrium with and equal to the present radiogenic heat; radial symmetry is preserved at all times. The more important consequences are: the present rate of evolution of lava is predicted approximately; if the silica-rich phase is identified with the crust, the fractionation must be about 400-fold; and the crust, as we now know it, was 80% formed within 2×10^8 years after the mantle solidified. Author (NSA)

N69-24296*# Volt Information Sciences, Inc., Washington, D. C.
CONTRIBUTION OF CORPUSCULAR RADIATION TO THE IONIZATION OF IONOSPHERE'S D-LAYER
V. F. Tulinov et al Washington NASA 24 Apr. 1969 10 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 7, no. 1, 1969 p 122–126
(Contract NAS5-12487)
(NASA-CR-100750; ST-AI-PF-10828) Avail: CFSTI CSCL 04A

The contribution of corpuscular fluxes to the ionization of the D-region is investigated on the basis of ultization of direct measurement data on their intensity at altitudes up to 90–95 km. It is shown that a high level ionization of D-region could be sustained at the expense of corpuscular radiation. Author

N69-24307# Ionosphären-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, DECEMBER 1968 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131, DEZEMBER 1968]
1968 43 p In GERMAN and ENGLISH
(Rept-270-F) Avail: CFSTI

Ionospheric data are tabulated for the F1, F2, and E-layers for December 1968. B.G.D.

N69-24368# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THEORETICAL WIND EFFECTS FOR THE 5-INCH HARP PROBE
B. A. Hodes and J. M. Frazier Oct. 1968 30 p refs
(AD-680207; BRL-MR-1946) Avail: CFSTI CSCL 4/1

The effect of crosswind on the dispersion of the 5 in. HARP probe has been investigated theoretically. Calculated wind corrections have been applied to the azimuth at apogee for a series of firings at Wallops Island, Virginia. These results indicate a mean deflection at apogee of less than 0.5 degrees. An estimate of wind effect on the impact of vertically launched probes is also given. Author (TAB)

N69-24447# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
MECHANISM FOR THE AURORAL EMISSION OF OI(6300 ANGSTROM)
P. Mahadevan Sep. 1968 17 p refs *Its* Res. Commun. No. 72
(AD-680673; Douglas-Paper-5247) Avail: Issuing Activity CSCL 4/1

Interaction between the metastably excited ion O+(2D) and ground state atoms of oxygen is suggested as a prime mechanism for the emission of OI(6300A) in the auroral F region of the night sky. Author (TAB)

N69-24511# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
ELECTROLYTIC CONDUCTIVITY OF SNOW AND GLACIER ICE FROM ANTARCTICA AND GREENLAND Research Report
Anthony J. Gow Oct. 1968 16 p refs
(AD-680180; CRREL-RR-248) Avail: CFSTI CSCL 8/12

Conductivity measurements have been made on snow and ice samples from pits and deep drill holes at a number of localities in Antarctica and Greenland. Data were obtained from deep cores representing more than 1900 years of continuous snow accumulation at Byrd Station, Antarctica, and more than 400 years deposition at Inge Lehmann, Greenland. Measurements of fresh precipitated snow from a single coastal location in McMurdo Sound, Antarctica, also yielded conductivities. The substantial increase observed in the conductivity of core samples from near the surface of the Ross Ice Shelf at Little America 5 can be attributed most probably to windborne salts of marine origin that had accumulated on the surface after the snow was deposited. TAB

N69-24516# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLAR WIND, MAGNETOSPHERE AND VAN ALLEN RADIATION BELT
G. A. Skuridin, V. D. Pletnev, V. P. Shalimov, and I. N. Shvachunov Jan. 1968 22 p Transl. into ENGLISH from Zemlya i Vselennaya (USSR), v. 1, no. 4, 1965 p 12–22
(AD-682812; FTD-MT-24-378-67) Avail: CFSTI CSCL 4/1

The structure of the earths Van Allen belts was studied in some detail. In order to understand the trapping of charged particles by the earths magnetic field the fundamental principles of orbit theory are reviewed and the significance of adiabatic invariants discussed. Using a model for the magnetosphere, the various charged particle drifts are analyzed in nonhomogeneous magnetic field traps. It is shown that the Van Allen belts are divided into inner and outer zones with altitudes at the equator ranging from 800 km in the western hemisphere to 1600 km in the eastern hemisphere. Author (TAB)

N69-24519*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
VLF ELECTRIC AND MAGNETIC FIELDS OBSERVED IN THE AURORAL ZONE WITH THE JAVELIN 8.46 SOUNDING ROCKET
Donald A. Gurnett and Stephen R. Mosier Feb. 1969 44 p refs
(Contract NSR-16-001-025; Grant NGR-16-001-043; Contract Nonr-1509(06))
(NASA-CR-100769; Rept-69-12) Avail: CFSTI CSCL 08N

Results of the Javelin 8.46 VLF electric and magnetic fields experiment flown from Ft. Churchill, Canada, on May 25, 1968, are discussed. This experiment carried three orthogonal magnetic loop antennas, three orthogonal long (3.16 meters) electric dipoles, two short (42 cm) electric dipoles, and six wideband (30 Hz to 10 kHz) receivers for amplifying signals from the various VLF antennas. Intense noise bursts with frequencies less than about 1.5 kHz were observed on all the electric antennas below 500 km altitude, but not on the loop antennas. The precession and spin modulation of these noise bursts suggest that the noise is generated by an interaction between the payload and the surrounding plasma. High frequency electrostatic noise bursts, from 5 to 30 kHz, were observed throughout the flight. Author

N69-24522# Naval Research Lab., Washington, D. C.
ON THE PLANE PARALLEL REPRESENTATION IN ATMOSPHERIC RADIATION TRANSFER
Robert R. Meier Dec. 1968 9 p refs
(AD-680601; NRL-6799) Avail: CFSTI CSCL 4/1

Solution of radiative transfer have been examined with respect to the validity of approximating a spherical scattering medium by a plane parallel layer. The results show that the plane parallel approximation is poor in the case of Lyman-alpha scattering by geocoronal atomic hydrogen. Author (TAB)

N69-24531# Joint Publications Research Service, Washington, D. C.
METHOD AND EQUIPMENT FOR INVESTIGATING TURBULENT TEMPERATURE FLUCTUATIONS IN THE SEA
N. K. Shelkovnikov et al 10 Apr. 1969 11 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., III: Fiz.-Astron. (Moscow), no. 1, 1968 p 25-31
(JPRS-47824) Avail: CFSTI

A method is described for investigating experimentally the geometry of turbulent inhomogeneities of the temperature field in the sea. Correlation analysis is presented as applied to given conditions. A description is given of new electronic equipment for continuously and synchronously recording temperature fluctuations at four spatially dispersed points in the sea, which has a sensitivity to temperature fluctuations of the order of 0.001°C. An MT-54 thermistor is used as the sensing element in the circuit. A sample of synchronous recording of temperature fluctuations at four points in the sea is given. Author

N69-24536# Ohio State Univ., Columbus. Dept. of Geodetic Science.
ESTABLISHMENT OF AN IDEAL WORLD GEODETIC SYSTEM Interim Report, Jul.-Dec. 1967
John Bedekas and Ivan I. Mueller Jan. 1968 7 p
(Contract DAAK02-67-C-0535)
(AD-680225; IR-1) Avail: CFSTI CSCL 8/15

The report shows the progress made during the months from July through December, 1967. The work was started on October 1, 1967, and the rest of the time was spent mostly on literature search and discussions to decide in which direction the research should proceed. Author (TAB)

N69-24542# Oslo Univ. (Norway). Inst. of Geophysics.
ON THE EFFECT OF VERTICAL EDDY TRANSPORT ON THE DISTRIBUTION OF NEUTRAL NITROGEN COMPONENTS IN THE D-REGION Technical Report, Jul. 1967-Sep. 1968
Eigil Hesstvedt and Ulf Bertil Jansson Sep. 1968 13 p refs
(Contract DAJA37-67-C-0848)
(AD-682757) Avail: CFSTI CSCL 4/1

The vertical distribution of neutral nitrogen components (N, NO, N2O and NO2) from 50 km to 100 km is studied theoretically. Two atmosphere models are presented, one where the number densities are determined by photochemistry alone and one where also vertical eddy transport is considered. It is shown that vertical eddy transport modifies the photochemical model in a drastic way and brings the theoretical results in much closer agreement with observations. Author (TAB)

N69-24571# Cosmic, Inc., Gaithersburg, Md.
INVESTIGATION OF CURRENT VOLTAGE CHARACTERISTICS OF SPACECRAFT MOUNTED SPERICAL ELECTROSTATIC ANALYZERS Final Scientific Report, 7 Aug. 1967-7 Aug. 1968
John J. Shea and Kenneth H. Carpentar 7 Sep. 1968 114 p refs
(Contract F19628-68-C-0012)
(AD-680416; AFCRL-68-0588) Avail: CFSTI CSCL 4/1

The current-voltage characteristic of a spherical probe in a flowing, Maxwellian plasma with an assumed spherically symmetric potential distribution is derived and expanded in Taylors series about plasma potential. The linear terms, which are independent of plasma sheath thickness, are applied to reduction of data from spherical electrostatic analyzers. A computer program, written in Fortran IV, uses multidimensional minimization techniques to perform least squares fitting of plasma ion mass, temperature, and density to the linear portion of current and log-current data from spherical analyzers flown in the ionosphere. Analysis of selected data yields reasonable values for plasma parameters and demonstrates the capabilities of this method of data reduction. Author (TAB)

N69-24584# White Sands Missile Range, N. Mex. Atmospheric Sciences Research Office.
TECHNICAL DATA PACKAGE FOR ATMOSPHERIC TEMPERATURE SENSOR MINI-LOKI
C. L. Tate and Bruce W. Kennedy Sep. 1968 48 p refs
(AD-680174; ECOM-5217) Avail: CFSTI CSCL 19/7

A complete specification for a Loki-Dart telemetry payload, the Mini-Loki, is presented. The package includes a descriptive technical data package, engineering drawings, and the results of one flight test. Author (TAB)

N69-24641# Ohio State Univ., Columbus. Dept. of Geodetic Science.
NUMERICAL EXAMPLES FOR DOWNWARD CONTINUATION OF GRAVITY ANOMALIES
Karl-Rudolf Koch Jul. 1968 32 p refs
(Contract AF 19(628)-5701)
(AD-682925; Rept-112; SR-23; AFCRL-68-0513) Avail: CFSTI CSCL 8/5

To compute gravity anomalies at the surface of the earth from airborne gravity measurements Poissons integral for the plane applied to gravity anomalies is regarded as an integral equation of the first kind, whose solution gives the sought anomalies. In the practical application the integration is replaced by a summation, so that a system of linear equations is obtained. This system is solved by successive approximations. Several examples are computed to continue anomalies downward in the centers of 5 min. x 5 min., 15 min. x 15 min., and 1 deg. x 1 deg. blocks at elevations of 9 km and 8 km. The results show that the successive approximations

converge fast. In case of flight elevations between 6 km and 10 km, however, the use of 5 min. x 5 min. blocks and of smaller blocks should be excluded from the downward continuation of airborne gravity measurements to avoid ill-conditioned matrices.
Author (TAB)

N69-24674*# Illinois Univ., Urbana. Aeronomy Lab.
ANALYSIS OF A ROCKET EXPERIMENT TO MEASURE IONOSPHERIC ELECTRON DENSITY
K. Seino and E. A. Mechtly *In its* Rocket Expt. Instrumentation 31 Dec. 1968 50 p refs (see N69-24672 12-14)
Avail: CFSTI CSCL 04A

A radio propagation experiment based on Faraday rotation and differential absorption measurements obtained from sounding rocket data is described in detail. Ground support equipment, rocket payload, and telemetry systems used in obtaining the required data are treated, with emphasis on the instrumentation for Faraday rotation and differential absorption data processing. Mathematical expressions for the rocket receiver output signal and the rocket spin signal are developed, and the operating theory of the data processing system is analyzed. In addition, a discussion of rocket precession, and the errors which it causes in measurements of electron density, is included. It was found that at altitudes less than 70 km, where the density is very low, the accuracy of the experiment is adversely affected by several environmental phenomena. It is therefore recommended that additional theoretical studies and careful examination of data be conducted, as well as modification of the present experimental techniques.
A.C.R.

N69-24684# Isotopes, Inc., Westwood, N.J.
NUMERICAL MODELS OF TRANSPORT, DIFFUSION, AND FALLOUT OF STRATOSPHERIC RADIOACTIVE MATERIAL Final Report
Harold Seitz, B. Davidson, J. P. Friend, and H. W. Feely 31 May 1968 103 p refs
(Contract AT(30-1)-3654)
(NYO-3654-4) Avail: CFSTI

A numerical model in two dimensions capable of simulating diffusion, mean circulation transport, particle fall velocity, and tropospheric rainout is described. The model incorporates a general anisotropic diffusion process with the principal axis of diffusion oriented along lines of constant potential vorticity which are approximated to be parallel to the tropopause configuration. Rainout is simulated by the fractional removal of material at selected rain "formation" levels; the fraction removed at any latitude is proportional to the observed rainfall (climatological) at that latitude. The capability of the model has been extended by incorporating a four season variation of the meteorological parameters. Three major prediction experiments were conducted with the simulation of the following injections as initial conditions. The multiple injection of strontium-90 into the polar and tropical stratospheres by the 1961–1962, U.S.A. and U.S.S.R. nuclear test series is discussed.
Author (NSA)

N69-24708# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
DEPOSITION AND EROSION OF SNOW BY THE WIND
Uwe Radok Sep. 1968 31 p refs
(AD-680179; RR-230) Avail: CFSTI CSCL 8/12

The theories of uniform and non-uniform drifting snow are summarized with special emphasis on drift transport as a function of wind velocity. It is confirmed that the snow drift process involves a mobile surface layer of saltating particles, with a self-regulating thickness depending only on the surface stress and not on the snow concentration in the free air stream. It is shown to be a characteristic of snow (in contrast to sand or silt) that saltation and suspension drift occur side by side and that the latter reaches predominance as the wind velocity rises through the most common range of surface values. Theoretical reasons and observational evidence are produced for the view that deposition or erosion occurs on the snow surface during snow drift primarily as the result of mass flux convergence or divergence in the free air stream.
Author (TAB)

N69-24750# Ballistic Research Labs., Aberdeen Proving Ground, Md.
LOW LATITUDE ELECTRON CONTENT AND IONOSPHERIC HEIGHT FROM A HYBRID FARADAY-DOPPLER PROGRAM
Irving L. Chidsey Nov. 1968 190 p refs Presented at Mich. Univ., Ann Arbor, 16–18 Oct. 1967
(AD-680210; BRL-1425) Avail: CFSTI CSCL 4/1

Dispersive doppler and faraday rotation data from 79 passes of 1961 Omicron 1 and 1961 Alpha-Eta 1 recorded at Johnston Island between 17 May and 15 Jul 62 were reduced, primarily by an improved faraday-doppler technique, to obtain electron content and effective ionospheric height data. Significant results obtained were: mean maximum low-latitude content, (3.5 plus or minus 0.5) x 10 to the 17th power electrons/sq meter; early post-sunrise rate of production (2.3 plus or minus 0.3) x 10 to the 13th power electrons/sq meter/sec; or, for an equivalent maximum electron density (1.4 plus or minus 0.3) x 10 to the 12th power electrons/cu meter, and (6.4 plus or minus 12) x 10 to the 7th power electrons/cu meter/sec. The mean effective ionospheric height was 378 plus or minus 23 km. A description of the improved, hybrid faraday-doppler technique is included.
Author (TAB)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N69-23415 Michigan Univ., Ann Arbor.
ANALYSIS, DESIGN, CONSTRUCTION AND VARIOUS APPLICATIONS OF A POLARIZED NEUTRON SPECTROMETER
Hugh Kendrick (Ph.D. Thesis) 1968 230 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-13341

The analysis, design, and construction of a polarized neutron spectrometer are described in detail. The facility is used to study an iron-nickel alloy, holmium, chromium, and iron. The third part describes a related investigation of Ti_2O_3 and V_2O_3 using unpolarized neutrons. Of the methods of polarizing neutrons discussed, Bragg reflection from magnetized single crystals of the ferromagnetic alloy fcc Co(8%Fe) was chosen. The principal reason for this choice was that monoenergetic neutrons were required for the subsequent investigations. The surface condition of the crystals was found to be important. After mechanical polishing, the beam was 99% polarized. Later, the intensity reflected by this monochromator was increased at least fourfold by bending of the crystals.
Dissert. Abstr.

N69-23470*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
MEASUREMENT OF LIQUID AND TWO-PHASE HYDROGEN DENSITIES WITH A CAPACITANCE DENSITY METER
George E. Turney and Roger W. Snyder Washington Apr. 1969 42 p refs
(NASA-TN-D-5015) Avail: CFSTI CSCL 14C

A three-dimensional, wire matrix, capacitance density meter was used to measure the density of liquid and two-phase hydrogen flow. The measurements were made in a 4-inch (10.6-cm) nominal diameter propellant feedline of a full-scale, simulated, nuclear-rocket test system. An evaluation of this capacitance density meter was made by comparing the density meter measurements with corresponding calculated densities in the feedline. The local hydrogen densities measured with the density meter were in relatively close agreement with the calculated densities. For the most part, the calculated and measured densities differed by less than ±15 percent of the full-scale (liquid hydrogen) density. Author

N69-23489*# Barringer Research, Ltd., Rexdale (Ontario).
ABSORPTION SPECTROMETER MODIFICATIONS AND FLIGHT TESTING Final Report
Jan. 1969 173 p refs
(Contract NAS9-7958)
(NASA-CR-99609; TR-69-79) Avail: CFSTI CSCL 17E

The spectrometer was extensively refurbished and re-aligned and all three modes of operation; NO_2, SO_2 and I_2 evaluated in the laboratory. The aircraft mounting fixture was also substantially rebuilt and an improved ground track camera and CCTV navigation system added. A NO_2/SO_2 survey was flown and very useful noise data were obtained for NO_2 and SO_2 wavelengths over a wide range of terrain materials. Typical noise levels measured were as follows: (1) 20 ppm-meters for SO_2 over rock and tree covered terrain; and (2) 15 ppm-meters for No_2 over rock and tree covered terrain. Iodine flights over the coast of Maine established: (1) the basic feasibility of I_2 detection from an aircraft; (2) the noise level of the I_2 channel is 10 ppm-meters over tree covered terrain and water; and (3) that significantly higher levels of I_2 occur in the atmosphere above the kelp-rich coastline than further inland. Airborne experiments were conducted in the Toronto area over Lake Ontario and 40 miles north of Toronto over Lake Simcoe. These included mass flow and "m" factor measurements of NO_2 plumes from lakeshore industries, vertical profiles of both SO_2 and NO_2 pollution layers and ground based monitoring of ambient variations in moving air for SO_2, NO_2 and I_2. The results of the NO_2 mass flow measurements showed very close agreement with ground truth measurements. Author

N69-23502# United Kingdom Atomic Energy Authority, Harwell (England).
POSITION SENSING DETECTOR ARRAY FOR A CHARGED PARTICLE MAGNETIC SPECTOGRAPH
D. L. Allan, G. V. Ansell, and R. K. Jolly Sep. 1968 13 p refs
(AERE-R-5897) Avail: CFSTI; UK 3s

An array of eight position-sensing detectors was mounted in the focal plane of the Harwell broad range charged particle magnetic spectograph and used successfully to measure the deuteron spectrum from the reaction $^{56}Fe(d,d')$ at E_d = 11.5 MeV. The method of mounting the detectors, and the operation of the associated electronic circuitry, are described.

N69-23513# Department of Supply, Melbourne (Australia). Aeronautical Research Labs.
PRE-ATTACHMENT MATCHING OF RESISTANCE STRAIN GAUGES ON A TEMPERATURE COEFFICIENT BASIS
I. G. Scott Jun. 1968 29 p refs
(ARL/SM-327) Avail: CFSTI

Various techniques for preattachment selection of strain gauges on a temperature coefficient basis are reviewed. A method is proposed whereby the gauge is clamped tightly between plates forming a specimen. The response of the gauge when the temperature of the specimen is changed is found to be almost identical with the response of the same gauge when attached and subjected to the same change in temperature. Author

N69-23559# Mound Lab., Miamisburg, Ohio.
LATENT IMAGE FADING IN PERSONNEL NEUTRON MONITORING FILM EXPOSED TO A MODERATED $Pu^{238}O_2$ SOURCE
E. N. Arnett 10 Jan. 1969 7 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1570) Avail: CFSTI

Latent image fading in neutron monitoring film was investigated for two weeks. One hundred and twenty pieces of neutron film were packaged in film badges and exposed to a moderated $^{238}PuO_2$ source at various time intervals. The daily exposure data indicated that there was 16% fading of neutron tracks after one week and 30% fading of neutron tracks after two weeks. Also, the weekly exposure data indicated that films receiving equal exposure for one week and developed on the second day of the following week had 17% fading of neutron tracks. Similarly, films receiving equal exposure for two consecutive weeks and developed on the second day of the third week had 30% fading of neutron tracks. The one- and two-week exposures approximate the radiation exposure which could be received by personnel exposed to neutron radiation in a $^{238}PuO_2$ process area. The combined results of latent image fading studies indicated that fading in neutron monitoring film cannot be accurately predicted on the basis of average energy alone. Author (NSA)

N69-23561*# Rensselaer Polytechnic Inst., Troy, N. Y.
CHROMATOGRAPHIC SYSTEMS ANALYSIS: FIRST-ORDER MODEL EVALUATION
Thomas F. Sliva Sep. 1968 98 p refs
(Grant NGL-33-018-091)
(NASA-CR-100707; RPI-MP-1) Avail: CFSTI CSCL 14B

A program to investigate system concepts through the use of mathematical models of the chromatograph is being undertaken. A model for an isothermal, packed chromatograph column for use with a single component system was derived. Neglecting second order diffusional effects, a solution to the first order mathematical model was obtained by classical techniques. Although this solution predicts the general trends of an actual chromatogram, it does not exactly predict the entire curve. It appears from the results that the second order was neglected, longitudinal diffusion and possibly other mechanisms, must be considered if an accurate representation of the process is to be obtained. Author

N69-23585 Duke Univ., Durham, N. C.
HIGH TEMPERATURE MILLIMETER AND SUBMILLIMETER WAVE SPECTRA OF LiD, LiF, LiCl AND AgCl
Edwin Forrest Pearson (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.90/Microfilm $3.00 Order No. 68-14334

A new type of high temperature spectrometer for operation in the millimeter and submillimeter wave region has been constructed and used for measurements of numerous rotational transitions. The first rotational transition of ^7LiD and ^6LiD was observed in the v = 0 and v = 1 vibrational states. Measurements on the rotational spectra of ^6LiF, ^7LiF, $^6Li^{35}Cl$, $^6Li^{37}Cl$, $^7Li^{35}Cl$ and $^7Li^{37}Cl$ were extended into the submillimeter region. Accurate evaluation of the rotational constants revealed small isotopic effects. The spectral constant was corrected for effects resulting from nonspherical electron distribution, nuclear wobbling, and anharmonicity of the internuclear potential. Silver chloride's rotational spectra was also extended to the submillimeter region. Precise rotational constants were obtained for all four naturally abundant isotopic species. From the rotational constants precise calculations of the potential functions and the vibrational constants were made. Dissert. Abstr.

N69-23584# Marquardt Corp., Van Nuys, Calif.
DEVELOPMENT OF A BREADBOARD MULTIELEMENT STAR DETECTOR Final Report, Mar. 1967–Sep. 1968
A. Asam, W. Heil, and R. Haas Dec. 1968 52 p
(Contract NAS5-10340)
(NASA-CR-100686) Avail: CFSTI CSCL 14B

A tradeoff design study indicated that a multielement detector strip employing a unique combination of a thin film photoconductor for optical sensing and a highly non-linear dielectric material, i.e., a ferroelectric, for signal integration could produce usable signals from low level photon irradiance produced by stars such as Alpheratz. An investigation of sensor strip readout methods proved that a commutator for sampling the elemental signals can be realized by thin film materials which would be compatible with the photoconductor/ferroelectric material combination. Thin film switching elements (TFT) based on CdS-Se materials were produced exhibiting a transconductance of 2000 microamperes per volt which is satisfactory for multiplexing the detector strip. Experiments with a multielement, thin film detector strip have demonstrated that elemental signal integration and signal storage is feasible that would enhance the star pattern detection capabilities. Author

N69-23587# Greek Committee for Atomic Energy, Athens.
A SIMPLE CRYOSTAT FOR N.Q.R. MEASUREMENTS
Fanny K. Milia Aug. 1968 8 p ref
(DEMO-68/8) Avail: AEC Depository Libraries

A simple and inexpensive cryostat is described, especially designed for NQR measurement in the range of 0° to −195°C. The system can be used for maintaining a constant temperature, as well as for measurements where a slow variation of temperature is desired. The set temperature can be maintained over periods up to 3 days with a stability of 0.5%. NSA

N69-23594*# North American Rockwell Corp., Los Angeles, Calif.
DESIGN, DEVELOPMENT, AND FABRICATION OF PORTABLE INSTRUMENTATION FOR NONDESTRUCTIVE TESTING OF COMPOSITE HONEYCOMB MATERIALS Final Report, 30 Jun. 1967–30 Sep. 1968
George Martin and J. F. Moore 3 Feb. 1969 165 p refs
(Contract NAS8-20764)
(NASA-CR-98390; NA-68-715) Avail: CFSTI CSCL 14B

The report describes an analytical and experimental program relating the variation in viscoelastic properties of an adhesive to the cohesive bond strength of the adhesive. The adhesive damping data predicted that the composite vibrational response amplitude would decrease with elevated temperatures, and the relaxation character of the degraded adhesive would show a smaller activation energy. Vibration analysis measurements verified that the damping of the adhesive was related to the cohesive bond strength by determinations of either the internal friction at the fundamental and harmonic frequencies or the relative vibration response peak amplitudes. The development of a nondestructive test system for measuring adhesive damping was directed toward the development of a high energy excitation–detection transducer system for one side bond strength measurements. Measurements on composite specimens at various temperatures showed a frequency–internal friction relationship which clearly distinguished differences in cohesive bond strength. Author

N69-23620# Tokyo Inst. of Tech. (Japan).
RESEARCH-REPORTS MEETING ON BETA-GAMMA-RAYS, AND THEIR INSTRUMENTS
Hisashi Horie 1967 79 p refs In JAPANESE and ENGLISH
(KURRI-TR-4; Conf-670656) Avail: AEC Depository Libraries

Due to the importance of measuring instruments, a research reports meeting on June 19 and 20, 1967, was held on the β and γ rays and their measuring instruments. Reports presented at the meeting are given in the form of short articles: anomalous parity states in odd-A nuclei; excited levels in ^{152}Gd, excited levels in ^{100}Ru and ^{102}Ru, short-lived activities produced by fast neutron bombardment, $\rightarrow^{bu}$ Q measurements of anomalous coupling states by the spin orientation method, multicounter goniometer, β–γ angular correlation and internal bremsstrahlung, improvement of β-ray spectrometer, Kakuken ρ = 75 cm air-core spectrometer, Riken $\sqrt{2}\pi$ air-core β-ray spectrometer, new spectrometers, data acquisition and analysis system, Ge(Li) detectors, semiconductor detectors amplifiers, neutron capture γ-ray measurements by Ge(Li) detector, measurements of low-energy γ rays and internal conversion electrons, and e-γ angular correlation measurement by Si(Li) detector. NSA

N69-23621 Saskatchewan Univ., Saskatoon.
A FABRY-PEROT INSTRUMENT FOR THE OBSERVATION OF THE ATMOSPHERIC HELIUM EMISSION AT 10830 Å
Yee Pan Neo (Ph.D. Thesis) 1968 229 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-14632

A 12-cm infrared Fabry-Perot instrument was designed, constructed and used to make some preliminary measurements on the twilight helium emission at 10830 Å. The instrument was operated with a single passband as a spectrometer and as a photometer. Pulse counting techniques were used to record the data. The Fabry-Perot spectrometer had a spectral half width of slightly more than 1 Å and was used to make an identification of the HeI emission at 10830 Å. Spatial scanning was used in the spectrometer. The intensities of the HeI and the OH lines were estimated from the spectra obtained. The intensity of the emission at 10830 Å was measured with the photometer as a function of the solar depression angle. Observations were made in the zenith and for solar depression angles greater than 8°. A sharp increase in the intensity of the emission at 10830 Å was observed during the presence of an auroral outburst. Dissert. Abstr.

N69-23632*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
MAGNETOMETERS FOR SPACE MEASUREMENTS OVER A WIDE RANGE OF FIELD INTENSITIES
B. G. Ledley May 1969 25 p refs Submitted for publication
(NASA-TM-X-63522; X-612-69-156) Avail: CFSTI CSCL 14B

One of the many by-products of space research was the rapid development of magnetometry in the past decade. Many spacecraft explore both magnetospheric and interplanetary regions; this has emphasized the development of magnetometers capable of measuring over a wide range of field intensities. This paper will discuss some of the wide range magnetometers developed by the Goddard Space Flight Center. The Center's magnetic field experiment flown on the fifth Orbiting Geophysical Observatory (OGO-5) contains both a Rubidium vapor magnetometer and a triaxial fluxgate with a digitally controlled field compensation system. These magnetometers and current development of these two types of magnetometers are described. Author

N69-23672 Utah State Univ., Logan.
OPTICAL INTERFEROMETRIC MEASUREMENT TECHNIQUES FOR THE STUDY OF ATMOSPHERIC GAS RADIATION MECHANISMS
Scott Paul Stewart, Jr. (Ph.D. Thesis) 1967 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-13783

In the interest of studying the photochemical processes of the hydroxyl emission of the atmosphere, an interferometer-spectrometer system was developed for observation of the near-infrared (1 to 6 μ) region. This apparatus was used in conjunction with a laboratory gas kinetic reaction system to obtain the first spectra of the fundamental and first overtone of OH produced by the H + O_3 reaction. The spectra were obtained with

10 cm^{-1} resolution using the unique approach of modulating the reaction itself and detecting the signal with a synchronous amplifier to surmount the large infrared thermal emission from the normal room temperature background. The engineering details necessary for using Fourier spectroscopy are presented, including modern, fast, computer programs for doing Fourier transformations with a digital computer. Dissert. Abstr.

N69-23699*# Stanford Research Inst., Menlo Park, Calif. Molecular Physics.
DEVELOPMENT AND TESTING OF AN IMAGE TUBE CAMERA AND SPECTOGRAPH Quarterly Progress Report, Period Ending 31 Mar. 1969
Robert L. Sharpless 10 Apr. 1969 4 p
(Contract NASr-49(26); SRI Proj. PAU-6376)
(NASA-CR-100688; Rept-9) Avail: CFSTI CSCL 14E

The objectives of this project as stated in the contract were (1) to develop a combination camera and spectograph using an image intensifier tube to obtain high sensitivity and (2) to provide the necessary qualified personnel, materials, and equipment for operation of the image tube camera and spectograph in support of the NASA electron beam field mapping experiment. The development of the image tube camera and spectograph has been covered in previous reports. The electron beam field mapping experiment was carried out on the morning of January 26, 1969. The image tube camera and spectograph performed well. The data reduction done so far indicates that the auroral streaks were out of the field of view of the camera. Author

N69-23741# Technische Hochschule Munchen (West Germany). Fakultaet Fuer Maschinenwesen und Elektrotechnik.
A SELF-CALIBRATING RADIOMETER FOR THE MEASUREMENT OF THERMAL RADIATION MICROWAVES OF THE EARTH'S SURFACE FROM AN AIRCRAFT [EIN SELBSTEICHENDES RADIOMETER ZUR MESSUNG DER THERMISCHEN MIKROWELLENSTRAHLUNG DES ERDBODENS VOM FLUGZEUG AUS]
Johann-Peter Hach (Ph.D. Thesis) 1968 30 p refs In GERMAN
Avail: CFSTI

Described is a microwave radiometer that utilizes two stable reference temperatures for feedback control together with a self adjusting modulation technique to obtain thermal radiation measurements from the earth's surface during overflights. The continuous calibration feedback to the two reference temperatures makes the registration independent of microwave frequency fluctuations. Transl. by G.G.

N69-23786# Instituto de Asuntos Nucleares, Bogota (Colombia).
CALIBRATION OF SCINTILLATION DETECTORS [CALIBRACION DE DETECTORES DE CENTELLEO]
J. A. Hernandez and M. C. Tejada 1968 39 p refs In SPANISH
(IAN-RS-ERA-2) Avail: CFSTI

A fast scintillation method for calculating the efficiency of a scintillation detector is described. The procedure is limited to integration of the differential spectrum obtained for various samples and to calculation of the efficiency of the crystal for measurement of an expression deduced on the basis of the decay scheme of the radioisotope. The efficiency thus obtained is presented in graphs as a function of the energy for each of the scintillators. An approximation method is then presented for calculation of the resolution of a detector. Various methods and a nomogram for the rapid determination of the activity of a sample are given. NSA

N69-23818# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
POLAROGRAPHIC TECHNIQUES APPLIED TO PROSPECTIVE ATMOSPHERIC PARTICULATE TRACERS
J. D. Lucwick *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol 2, pt. 3 Oct. 1968 p 63–64 (See N69-23812 12-13)
Avail: CFSTI

A polarographic method, anodic stripping, for determining the amount of a single tracer particle in a rain drop or snow crystal is described. Antimony, cadmium, and zinc are recommended as particle tracers for these measurements. NSA

N69-23830# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
STUDIES OF PRECIPITATION ELECTRICAL CHARGE
M. T. Dana *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 140-149 refs (See N69-23812 12-13)
Avail: CFSTI

Field observations of the electric charges of non-thunderstorm precipitation were carried out at three locations in Washington state. These studies are of potential importance to an understanding of precipitation scavenging mechanisms, particularly when submicron particulates are involved. The instrument system used for electric charge measurements is described. The measurements are tabulated along with complete meteorological and rain drop size data for each sample measured, and data on charge distribution for several samples are plotted. The experimental results are compared with precipitation charging theory and found to be in qualitative agreement, although the magnitudes of electric charge were substantially higher than those predictable from ionic diffusion and coagulation mechanisms. NSA

N69-23831# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
IMPROVEMENTS IN RAINDROP CHARGE MEASURING SYSTEM
C. A. Ratcliffe and N. C. Holtink *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 150–153 refs (See N69-23812 12-13)
Avail: CFSTI

Improvements incorporated into the raindrop charge measuring system used in atmospheric studies reduced transducer microphonics, improved charge induction geometry, reduced adverse environmental operating characteristics, and increased the charge sensitivity. The use of an electrostatic pen recording method allowed system operation under adverse climatic conditions. Extensive field tests, on a continuing basis with power obtained by using batteries for the electronics and a portable ac generator for the recording equipment, evidenced marked operational improvement. Author (NSA)

N69-23839# Bhabha Atomic Research Centre, Bombay (India). Reactor Operations Div.
APPARATUS FOR THE DETERMINATION OF DISSOLVED GASES IN NUCLEAR REACTOR COOLANTS (WATER)
D. G. Vartak, C. J. Jose, and L. H. Prabhu 1968 19 p
(BARC-361) Avail: CFSTI

A system has been set up to analyze the dissolved gases in reactor coolants. It consists of two parts, one for stripping out the dissolved gases and measuring the total volume and the other called the analyzer for the determination of gas percentage composition. The analyzer can be used independently for the analysis of a sample of a mixture of carbon dioxide, oxygen, nitrogen and hydrogen. Author

N69-23853# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
FOCUSING OF THE TIME-OF-FLIGHT DIFFRACTOMETER FOR STRUCTURE ANALYSIS: THE EXPERIMENTAL CHECK
A. Holba, J. Holas, E. Maliszewski, and L. Sedlakova 1968 30 p
(JINR-E14-3759) Avail: CFSTI

The experimental check of focusing of the neutron time-of-flight diffractometer for crystal structure analysis is presented. The obtained results proved the formula for focusing. The intensity of the focused diffractometer increased by an order of magnitude as compared with the previous diffractometer of the same resolution.
Author (NSA)

N69-23885# Bhabha Atomic Research Centre, Bombay (India). Technical Physics Div.
STUDY OF FIELD EMISSION AND STANDARDISATION OF ITS TECHNIQUES
Devaki Ramanathan and P. Vijendran 1968 20 p refs
(BARC-366) Avail: CFSTI

A detailed study of the phenomena and potentialities of a field emission cathode was undertaken. Techniques were considered which include setting up a UHV system, fabrication of tips, conductive and phosphor coating of the field emission tube. Preliminary studies to verify that Fowler–Nordhem equation were performed, and photographing the patterns was achieved.
Author

N69-23895*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
SURFACE TEMPERATURE MAPPING WITH INFRARED PHOTOGRAPHIC PYROMETRY FOR TURBINE COOLING INVESTIGATIONS
Frank G. Pollack and Robert O. Hickel Washington May 1969 49 p refs
(NASA-TN-D-5179) Avail: CFSTI CSCL 14B

An infrared photographic pyrometry system was investigated to map surface temperature distribution in the range of 1000° to 2500°F. The system was designed to determine the surface temperature distribution of cooled turbine vanes installed in a static cascade facility. A relative energy measurement technique was used for calibrating film density to surface temperature. The calibration method was independent of surface emissivity and viewpath attenuation factor, and compensates for photographic variations. Experimental test targets in air and a hot gas stream were photographed. These thermal images of the targets are evaluated. Temperature information is reduced from each thermal image. The data are presented in the form of calibrated temperature contour maps. Temperature measurements with this method were within the 1-percent accuracy of the calibration point reference temperature over a considerable portion of the film response curve. Author

N69-24256# Compagnie Generale de Telegraphie sans fil, Paris (France).
A HEAD UP DISPLAY [UN COLLIMATEUR DE PILOTAGE]
P. J. Deliac *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 3 p In FRENCH (See N69-24230 12-02)
Avail: CFSTI

The philosophy of the system is discussed, and the improvements involved in the usage of a piloting collimator are enumerated, including the advantages obtained with relation to classic panel instruments, advantages peculiar to the collimator technique, and improvements in flight safety and pilot instruction. The ability of the equipment to collect all the facts aboard and present them clearly to the pilot is considered, with reference to image formation, the optical collimation system, and operational reliability.
Transl. by P.A.B.

N69-24257*# National Aeronautics and Space Administration, Manned Spacecraft Center, Houston.
FLOW TEST DEVICE
Bernard J. Rosenbaum, inventor (to NASA), Mike Oberschmidt, inventor (to NASA), and Joan J. Fitzgerald, inventor (to NASA) Issued 4 Feb. 1969 (Filed 19 Aug. 1966) 7 p Cl. 73–188
(NASA-Case-XMS-4917; US-Patent-3,425,276;
US-Patent-Appl-SN-574283) Avail: US Patent Office CSCL 14B

A fluid flow sensor is described which is attached to a collapsible linkage device which is insertable in its collapsed position through the restricted throat of a rocket motor combustion chamber and then externally manipulated to properly position the sensor at the various injector ports for testing fluid flow. The sensor is on one of three expandable fingers carried by a mandrel. Relative rotation between the inserted mandrel and a threaded sleeve causes the linkage to expand and position the sensor over one of the injector ports.
Official Gazette of the U.S. Patent Office

N69-24285# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
DEVELOPMENT OF FREE-MOLECULAR LANGMUIR PROBES FOR MEASUREMENT OF ELECTRON TEMPERATURE AND NUMBER DENSITY IN SHOCK-TUNNEL FLOWS
Michael G. Dunn and John A. Lordi May 1968 38 p refs
(CAL-AN-2101-Y-2) Avail: CFSTI

A study is presented of thin-wire Langmuir probes used to measure the electron temperature and electron density of the inviscid nozzle flow of a short-duration reflected-shock tunnel at conditions for which the flow was free molecular with respect to the probe diameter. Experiments were conducted at equilibrium reservoir conditions of 6850°K and 22 atm pressure in air and at 8000°K and 9.35 atm pressure and at 6090°K and 10.4 atm pressure in argon. The electron densities were simultaneously measured using microwave interferometers and found to be in good agreement with the values obtained from the Langmuir probe. The experiments confirmed the validity of Laframboise' theoretical predictions for ion collection, including that in the orbital-motion limited region. The electron temperatures measured in both the air and argon plasmas were found to be significantly greater than the calculated heavy-particle translational temperature, although in all cases the Langmuir probe results indicated that the electron velocity distribution was Maxwellian.
Author

N69-24293# Stanford Linear Accelerator Center, Calif.
SLAC SPIRAL READER PROJECT
M. Anderson, D. Budenaers, J. Caponera, R. Cochran, R. Good et al Nov. 1968 9 p Presented at the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers, Argonne, Ill., 28–30 Oct. 1968 Sponsored in part by AEC
(SLAC-PUB-529) Avail: CFSTI

The design characteristics of the SLAC spiral reader which is used to process bubble chamber film are discussed. These include the projection system, film transport system, electronic and interface logic, and on-line control program and calibration program.
NSA

N69-24331*# General Dynamics Corp., San Diego, Calif.
LIGHT RADIATION DIRECTION INDICATOR WITH A BAFFLE OF TWO PARALLEL GRIDS
James W. Mildice, inventor (to NASA) Issued 25 Mar. 1969 (Filed 9 Feb. 1966) 5 p Cl. 250-237
(Contract NAS3-3232)
(NASA-Case-XNP-3930; US-Patent-3,435,246;
US-Patent-Appl-SN-526665) Avail: US Patent Office CSCL 20F

A light radiation direction sensor is designed comprising a photoelectric sensitive cell or sensor, in front of which a light baffle is positioned, to limit the light which may impinge upon the sensor only to light radiating towards the sensor from directions in a unipolar direction component. In the baffle's two coplanar arrays the mutually parallel, regularly spaced longitudinal light interceptors are positioned so that an opposite edge of a corresponding longitudinal interceptor of each of the arrays is in juxtaposition in a spaced apart side-by-side relationship. This limits the direction from which light may impinge on the sensor to directions on one side of a direction perpendicular to the coplanar arrays.
Official Gazette of the U.S. Patent Office

N69-24463# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

EVALUATION OF FOREST CANOPIES BY PHOTOGRAPHY Research Report

Philip L. Johnson and Theodore C. Vogel Oct. 1968 29 p refs

(AD-680182; CRREL-RR-253) Avail: CFSTI CSCL 14/5

A technique for evaluating forest canopies was developed based on the use of a divergent lens system to obtain hemispherical photographs of tree crowns. The photography was processed from 35 mm film and enlarged as a silhouette, and the light transmission was measured with a specially fabricated macrodensitometer. It is shown by application to a variety of problems in diverse geographical areas that this technique can be used for measuring both temporal and spatial changes in the canopy, for estimating the shade light climate, and for specifying the probability of target detection through a canopy. Data are presented to analyze changes caused by explosions, radioactivity, growing season, and vegetation types. The geometry of gaps in three crowns is discussed and the nature of shade light quality under forests is illustrated. Author (TAB

N69-24497# Brookhaven National Lab., Upton, N. Y.

LARGE DIGITIZED SPARK CHAMBER SPECTROMETER AND ON-LINE COMPUTER SYSTEMS

S. J. Lindenbaum [1968] 21 p refs Presented at the Intern. Conf. on Advan. Data Processing for Bubble and Spark Chambers, Argonne, Ill., 28–30 Oct. 1968 Sponsored by AEC

(BNL-13130; Conf-681025-12) Avail: CFSTI

A double V (vertex) magnetic spectrometer system consisting of two multiparticle magnetic spectrometer arms, utilizing spark chamber hodoscopes with automatic digitation of spark location, via magnetostrictive readout digitized by scaler readings, is described. It is designed for the automatic detection and measurement of the momenta of charged decay particles from double vertex events. The raw data is handled by a local data handler which stores the data in a local computer memory and between AGS pulses (every 2.5 sec) sends a preselected sample to the PDP-6 computer system of the Brookhaven On-Line Facility. This on-line facility is also described. Author (NSA)

N69-24534# Australia National Univ., Canberra. Dept. of Nuclear Physics.

STATES IN 27Al AND 89Y USING HIGH RESOLUTION SURFACE BARRIER COUNTERS

G. M. Crawley, D. L. Powell, and B. V. Narasimha Rao 1968 16 p refs

(ANU-P-415) Avail: AEC Depository Libraries

The resolution of a solid state detector was investigated, and a best value of about 16 keV was obtained after cooling. The energy levels of ^{89}Y and ^{27}Al were measured with this detector. New states were observed at around 3.0 MeV and 3.7 MeV in ^{89}Y and over 20 new levels were noted in ^{27}Al. Author (NSA)

N69-24537# Arkansas Univ., Fayetteville. Dept. of Physics.

INVESTIGATION OF THE ULTIMATE CAPABILITIES OF THE MAGNETIC FLUX SENSOR Final Report

Otto Henry Zinke 1968 35 p

(Contract DAHC01-67-C-0224)

(AD-680220) Avail: CFSTI CSCL 14/2

The magnetic flux sensor (MFS) is a newly discovered device for measuring resistance and permeability of metal samples. A preliminary investigation of its sensitivity showed it to be capable of determining the resistance of metal samples to within 1.1 x 10 to the -7th power. This report contains the results of a theoretical investigation starting with a development of AC magnetic circuit theory. Use of theory substantially reduced the difficulties in nulling the sensor and was also important together with an additional measurement in showing why the ultimate sensitivity was not achieved. Determination of the distribution of the magnetic field in the sensor gap was made experimentally and is reported here both to demonstrate use of the sensor and to determine where radiation would produce a maximum response should the sensor be used as a radiation detector. Finally, some work related to the determination of the emissivities of foils is presented. Author (TAB)

N69-24644# Pakistan Inst. of Nuclear Science and Technology, Islamabad. Nuclear Physics Div.

THEORETICAL CALCULATION OF THE LOW ENERGY EFFICIENCIES OF CYLINDRICAL Ge(Li) DETECTOR

A. A. Z. Ahmad and N. M. Ahmad May 1968 20 p

(PINSTECH/PHY-16) Avail: AEC Depository Libraries

Efficiencies for a cylindrical Ge(Li) detector for gamma rays were calculated theoretically. An IBM 1620 computer was used for obtaining numerical values. Efficiencies were found for different sizes of the detector and also for different values of source to crystal distance and energy. Author (NSA)

N69-24581# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.

THE USE OF RADIOISOTOPES IN DETECTOR CALIBRATIONS

J. H. McCrary 27 Aug. 1968 13 p refs

(EGG-1183-1401; L-226) Avail: CFSTI

Several possible radioisotope gamma sources for calibrating photoelectric diodes and fluor photodiodes for gamma detection are discussed. Source requirements and the experimental procedure are described. NSA

N69-24603# Illinois Univ., Urbana.

THE UNIVERSITY OF ILLINOIS DOLLY SYSTEM

Richard M. Brown and Robert W. Downing [1968] 10 p Presented at the Intern. Conf. on Advanced Data Process. For Bubble and Spark Chambers, Argonne, Ill., Oct. 1968

(COO-1195-154; Conf-681025-7) Avail: CFSTI

A modified version of the POLLY system for bubble chamber film scanning is proposed, called DOLLY. Notable differences from the POLLY design are multiple CRT film drive, larger scanning aperture, digital distortion corrections and slice scanning, and slice segment alignment and curvature. NSA

N69-24604# Gulf General Atomic, San Diego, Calif.

CALIBRATION AND USE OF A 5-IN.-DIAM LITHIUM GLASS DETECTOR

J. M. Neill, D. Huffman, C. A. Preskitt, and J. C. Young 2 Dec. 1968 44 p refs

(Contract AT(04-3)-167)

(GA-9048) Avail: CFSTI

The history of the use of a 5-in.-diam by 0.5-in.-thick ^{6}Li glass scintillator as an intermediate energy neutron detector was described. Difficulties in computing its efficiency directly were found, principally these were due to uncertainties in its composition and uncertainties in the cross sections for $^{6}Li(n,\alpha)$ and possibly others. A record of the efficiency estimates used in previously published data is set forth. The detector efficiency has been calibrated experimentally over the range 50 eV to 720 keV, and this efficiency function has been extended to higher and lower energies by other means. The efficiency of the ^{6}Li glass scintillator begins to increase above 1 MeV incident neutron energy due to inelastic scattering. Methods for removing gamma backgrounds present with this detector, including pulse shape discrimination and use of a depleted ^{6}Li scintillator were discussed. An alternate method which is believed to be more satisfactory was also developed. Author (NSA)

N69-24607# California Univ., Livermore. Lawrence Radiation Lab.

PLUTONIUM SURVEY WITH AN X-RAY SENSITIVE DETECTOR

J. F. Tinney, J. J. Koch, and C. T. Schmidt 15 Jan. 1969 28 p Presented at the Health Phys. Soc. Midyear Topical Symp., Los Angeles, 29–31 Jan. 1969 Sponsored by AEC
(UCRL-71382; Conf-690103-4) Avail: CFSTI

Traditionally, plutonium surveys have been conducted with alpha-sensitive detectors. More recently, however, x-ray detectors have been developed for this purpose. The design and performance of the low-energy x- and gamma-ray detector developed at LRL for plutonium survey are described. The results of a plutonium survey conducted under field conditions with this detector and a conventional alpha survey instrument are also presented. Author (NSA)

N69-24816# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
SEMIAUTOMATIC TLD READER
W. F. Splichal, Jr. Dec. 1968 13 p
(Contract AT(07-2)-1)
(DPST-68-610) Avail: CFSTI

A semiautomatic thermoluminescent dosimeter reader was developed to measure simultaneously the light emitted from two TLD's. The reader has adjustable nitrogen purge, preheat, heat, and signal storage which can be set up to cycle automatically with a minimum of operator manipulation. Provision is made to plot a glow curve during heating and to provide a digital readout at the end of the reading cycle. Individual heating, high voltage, and sensitivity controls enable the instrument to measure light emitted from either powder or crystal TLD's exposed to a wide range of radiation levels. Author (NSA)

N69-24820# Services Electronics Research Lab., Baldock (England)
HOLOGRAPHIC RECORDING ON PHOTOSENSITIVE IODIDE FILMS
M. R. Tubbs (Warwick Univ., Engl.), M. J. Beesley, and H. Foster *In its* Serl Tech. J., vol. 19, no. 1 Feb. 1969 7 p refs Submitted for publication (See N69-24617 12-34)
Avail: CFSTI

Holograms were successfully recorded on sensitized lead iodide layers using the 4880 Å radiation from an argon ion laser. These holograms require no processing and a reconstructed image can be observed immediately after exposure. The properties of sensitized iodide layers are compared with those of conventional photographic emulsions and it is suggested that they may have advantages for certain holographic applications. Author

N69-24824# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
FOUR-CHANNEL MONITOR FOR AIRBORNE RADIOACTIVE CONTAMINANTS
W. J. Woodward Nov. 1968 16 p refs
(Contract AT(07-2)-1)
(DP-1176) Avail: CFSTI

An instrument was developed to monitor continuously four locations for airborne radioactive contaminants. Each monitoring channel contains five plug-in circuit boards connected to form a count rate meter with five ranges and variable time constant. Author (NSA)

N69-24827# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
MEASUREMENTS OF CARTESIAN COORDINATES USING A SEMIAUTOMATIC DEVICE FOR SCANNING AND MEASURING SPARK CHAMBER PICTURES
I. K. Vzorov 1968 9 p refs In RUSSIAN
(JINR-P13-4012) Avail: AEC Depository Libraries

A method is described for the determination of Cartesian coordinates on a semiautomatic device which is designed for measuring polar coordinates of particle tracks in spark chamber photographs. NSA

N69-24847# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
SURFACE ISOTOPIC ANALYSIS BY LASER SOURCE SINGLE FOCUSING MASS SPECTROMETER
Jean-Francois Eloy, Pierre Contamin, Rene Stefani, and Ayme Cornu 10 Apr. 1968 13 p refs Presented at the 16th Ann. Conf. on Mass Spectrometry and Appl. Topics, Pittsburgh, Pa.
(CEA-Conf-1111; Conf-680543-1) Avail: AEC Depository Libraries

It is shown that, with a very simple and cheap apparatus, it becomes possible to obtain rapid superficial isotopic analysis. Operation of the system gives series of data for orientation studies of phenomena involving appreciable modifications in isotopic ratios. Improvements are expected both in precision and detection limit by increasing ion transmittance of the system source-spectograph and energy of the ions. Subsequent application could involve problems of chemical composition, after study of parameters governing ionic yields. Author (NSA)

N69-24672*# Illinois Univ., Urbana. Aeronomy Lab.
ROCKET EXPERIMENT INSTRUMENTATION
31 Dec. 1968 116 p refs *Its* Aeronomy Report no. 30
(Grant NsG-511)
(NASA-CR-100758) Avail: CFSTI CSCL 14B

CONTENTS:

1. DESIGN OF POLARIZATION ADJUSTMENT INSTRUMENTATION FOR A ROCKET PROPAGATION EXPERIMENT R. C. Condon and E. A. Mechtly 65 p refs (See N69-24673 12-14)

2. ANALYSIS OF A ROCKET EXPERIMENT TO MEASURE IONOSPHERIC ELECTRON DENSITY K. Seino and E. A. Mechtly 50 p refs (See N69-24674 12-13)

N69-24673*# Illinois Univ., Urbana. Aeronomy Lab.
DESIGN OF POLARIZATION ADJUSTMENT INSTRUMENTATION FOR A ROCKET PROPAGATION EXPERIMENT
R. C. Condon and E. A. Mechtly *In its* Rocket Expt. Instrumentation 31 Dec. 1968 65 p refs (See N69-24672 12-14)
Avail: CFSTI CSCL 14B

In regard to rocket investigation of the lower ionosphere, the designed development of circuitry to sense the polarization and to alter the parameters of the radio transmitter so that its output becomes circular are discussed in detail. Results of polarization tests conducted on recent rocket shots are presented, and a qualitative and quantitative analysis of the polarization correction system is given. A.C.R.

N69-24700# Naval Radiological Defense Lab., San Francisco, Calif.
CHARGED PARTICLE TRACKS IN POLYMERS NO. 7: SENSITIVITY ENHANCEMENT OF LEXAN
Eugene V. Benton and Richard P. Henke Nov. 1968 12 p refs
(AD-682922; USNRDL-TR-68-136) Avail: CFSTI CSCL 18/4

Ultraviolet radiation in the presence of oxygen has been used to greatly enhance track-etching rates in Lexan polycarbonate nuclear particle track detector. When irradiated detectors are stored in darkness, the slow variation of chemical track reactivity with the age of latent tracks can be explained as being caused by the presence of oxygen. Author (TAB)

N69-24706# Ballistic Research Labs., Aberdeen Proving Ground, Md.
TEMPERATURE EFFECT ON SPECTROMETER SLIT WIDTH AND PHOTOMULTIPLIER SENSITIVITY
Aivars Ozolins, William C. Lineberger and Franklin E. Niles Oct. 1968 20 p refs
(AD-680206; BRL-MR-1942) Avail: CFSTI CSCL 14/2

Variations in intensity measurements at 510.0 nm resulting from temperature changes have been recorded using a 0.5-meter Ebert scanning spectrometer equipped with a dual unilateral curved jaw slit assembly. Photons were detected by either a S-13 photomultiplier or a S-5 photomultiplier. The variations were found to be consistent with an effective change of -0.10 plus or minus 0.02 micrometer per degree C in the width of the spectrometer slits and with sensitivity changes of -0.8 and -0.45 percent per degree C for the S-13 and S-5 tubes, respectively. Author (TAB)

N69-24723# Pakistan Inst. of Nuclear Science and Technology, Islamabad. Nuclear Physics Div.

Ge(LI) DETECTOR USED IN A PAIR SPECTROMETER CONFIGURATION

Nighat Masud Ahmed, Abul Faiz Mohammed, Mohammad Ramzan Najam, Zafarullah Khan, and Hameed Ahmed Khan May 1968 11 p

(Pinstech/Phy-13) Avail: AEC Depository Libraries

A three crystal pair-spectrometer with a Ge(Li) detector as the central crystal has been set up. It has been used to record the pair spectrum of ^{72}Ga. The results obtained and the relative efficiency calibration of the spectrometer are discussed. Author (NSA)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N69-23390 Illinois Univ., Urbana.

THE RELATIONSHIP BETWEEN THE MACHINE-TOOL STRUCTURE AND ITS COST

Isaac Moked (Ph.D. Thesis) 1967 253 p

Avail: Univ. Microfilms: HC $11.50/Microfilm $3.30 Order No. 68-8173

The frame of a scientific method for the evaluation of design and economic merits of machine tools and their elements, based on a systems analysis approach, is proposed. The problem is formulated as a linear programming model with an objective, cost function. Calculation methods for the stiffness of principal structural elements of a machine tool, are developed. A cost evaluation method is discussed. The derivation of a numerical figure of merit, representing the design and economic merits of a machine tool and its components, is described. Methods of controlling and improving the structural components of machine tools are discussed, stressing the potential possibilities of the control of the damping characteristics. A new concept of a dynamic evaluation criterion is proposed. Dissert. Abstr.

N69-23402 Stanford Univ., Calif.

STATIC AND DYNAMIC PROPERTIES OF HYDROSTATIC THRUST GAS BEARINGS WITH CURVED SURFACES

Fritz Hugo Rehsteiner (Ph.D. Thesis) 1968 328 p

Avail: Univ. Microfilms: HC $14.85/Microfilm $4.20 Order No. 68-15090

The influence of plate curvature on the static and dynamic properties of hydrostatic or externally pressurized, orifice-regulated thrust gas bearings is investigated. Explicit theoretical and experimental results are presented for circular bearings one plate of which is flat and the other a paraboloid of revolution. The main part of the theory is based on classical lubrication theory in which fluid inertia is neglected. The static behavior of circular bearings having curved surfaces, with parallel and with inclined plate axes, is treated in detail. Dissert. Abstr.

N69-23437# Bureau of Mines, Minneapolis, Minn. Twin Cities Mining Research Center.

ENERGETICS OF PERCUSSIVE DRILLS

William E. Bruce and James Peone Apr. 1969 35 p refs

(BM-RI-7253) Avail: Issuing Activity

The Bureau of Mines performed drill calibration tests on two industrial percussive drills of 2-5/8- and 3-1/2-inch piston diameters to determine operating characteristics for their use in conjunction with penetration rate data in developing drillability equations and furthering the knowledge of percussive drills. The use of a linear velocity transducer for measuring piston velocities and application of its instrumentation are described. Data presented include relationships between maximum piston velocity and feed air pressure. Other results confirm the theory or data of previous investigators, and some comparisons are made with the performance prediction formulas of other investigators. Author

N69-23438# Bureau of Mines, Morgantown, W. Va. Coal Research Center.

TURBINE BLADE WEAR BY COAL ASH IN WORKING FLUID AT 1200°F

James P. McGee, Arthur J. Liberatore, Donald C. Strimbeck, and Gerald B. Goff Apr 1969 18 p refs

(BM-RI-7255) Avail: Issuing Activity

A 1,000 hour test with a gas turbine at 1,200°F showed a working fluid of 1 gr of ash per 100 scf of power gas (79 percent of the ash 7 to 35 microns in diameter) to be excessive for acceptable blade wear for commercial practicability. Blades in the turbine consisted of about 20 percent each of chromium, cobalt, and nickel; 3 percent molybdenum; 2-1/2 percent tungsten; and smaller amounts of manganese, columbium, and tantalum. Erosion of both the fronts and backs of the turbine nozzles was particularly heavy, the trailing edges being worn to a featheredge. Erosion of the buckets was less marked, although the leading edges were somewhat pitted. A refractory-lined combustor performed efficiently and with little abrasion of the lining by the ash-laden gas. Author

N69-23466*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

VIBRATION OF SHAFT FACE SEALS AND STABILIZING EFFECT OF VISCOUS AND FRICTION DAMPING

Thomas N. Strom, Lawrence P. Ludwig, and John C. Hudelson Washington Apr. 1969 20 p refs

(NASA-TN-D-5161) Avail: CFSTI CSCL 13I

In inert and reducing environments both at room and elevated temperatures, undamped seals operated with severe vibration which caused early bellows fatigue and high leakage rates of a 1.57 inch (3.99 cm) mean diameter seal operating to speeds of 165 feet per second (50.3 m/sec) at 24 000 rpm. Friction damping by mechanical dampers and the viscous damping by oil in the bellows were both effective in maintaining seal stability. Nosepiece temperatures caused by the sliding contact were high enough to reduce hardness of the mating seal seats. Author

N69-23496 North Carolina State Univ., Raleigh.
EFFECT OF FILAMENT FRICTION ON EXTENSIONAL BEHAVIOR OF CONTINUOUS FILAMENT TWISTED YARNS
Dong Wha Kim (Ph.D. Thesis) 1968 169 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-14661

A basic theoretical treatment is made of the influence of interfilament friction on the mechanical extension properties of twisted continuous filament yarns. In the past the behavior and effect of fiber to fiber friction and relative fiber movement has been investigated for only two limiting cases, infinite and zero friction. In the present work, a formal analytical approach is presented to describe the intermediate friction region existing between the two limiting systems. A friction model is proposed in which the cross section of the yarn is divided into a central core and an outer annular region by means of a slip boundary. The location of the boundary of separation of these regions and its effect on the extensional behavior of a yarn as related to the significant filament and yarn parameters including the filament migration rate are discussed. Dissert Abstr.

N69-23528*# Franklin Inst., Philadelphia, Pa. Research Labs.
ANALYSIS AND PERFORMANCE OF THE GAS-LUBRICATED TILTING PAD THRUST BEARING Interim Report
W. Shapiro and R. Colsher Oct. 1968 63 p refs Sponsored in part by NASA
(Contract Nonr-2342(00))
(NASA-CR-100673; I-A2049-30) Avail: CFSTI CSCL 13I

The inherent self aligning capability and superior resistance to thermal distortion, of the gas lubricated tilting-pad thrust bearing, could often offset load capacity limitations and make it an attractive compromise for many applications. A numerical treatment for analyzing the tilting-pad thrust bearing is presented along with extensive performance information for a particular pad geometry. An optimum hydrodynamic crown profile and related dimensions are determined. The range of validity of incompressible theory and the rectangular approximation are also developed. Author

N69-23683*# Rocketdyne, Canoga Park, Calif.
THE TRANSIENT PERFORMANCE OF A HYDRAULIC TURBINE DRIVEN INDUCER: COMPUTER PREDICTIONS AND TEST VERIFICATION Final Report
J. A. King and E. C. Farrel Feb. 1969 203 p
(Contract NAS3-10280)
(NASA-CR-72518; R-7747) Avail: CFSTI CSCL 13L

Two computer programs, an analog and a digital, were developed to predict the transient performance of a low-speed inducer driven by a hydraulic turbine. An inducer-turbine unit was designed, fabricated, and tested to determine if the predictions were correct. The test results verified the validity of the analytical models. Author

N69-23720 Cincinnati Univ., Ohio.
ESTIMATION OF STATES AND PARAMETERS
Russell Fay Henke (Ph.D. Thesis) 1968 197 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-15183

Two approaches are presented to the general problem of the identification of dynamical characteristics of physical systems based on empirical input-output data which may be incomplete or of limited precision. Within the framework of a general estimation formulation, nonsequential and sequential estimation techniques, applicable particularly to machine tool problems, are developed. Attention is devoted to those systems in which ordinary differential equations adequately describe the system, some a priori knowledge of the form of the differential equations is available, and no assumptions are necessary concerning the statistical character of observational errors or input disturbances. The latter condition corresponds closely to the situation usually encountered in practice. Dissert. Abstr.

N69-23738*# General Motors Corp., Indianapolis, Ind. Allison Div.
SINGLE-STAGE EXPERIMENTAL EVALUATION OF BOUNDARY LAYER BLEED TECHNIQUES FOR HIGH LIFT STATOR BLADES. PART 2: DATA AND PERFORMANCE OF SINGLE SLOTTED 0.65 HUB DIFFUSION FACTOR STATOR
G. Seren and R. H. Carmody Aug. 1968 198 p refs
(Contract NAS3-7900)
(NASA-CR-54570; EDR-5862-Pt-2) Avail: CFSTI CSCL 13I

A test is described which is part of an overall program to establish experimentally the extent to which it is feasible to increase compressor stator loading and stall-free flow margin by employing suction surface boundary layer bleed techniques. A secondary objective was to obtain blade element data for design use. Overall and blade element performance of a row of 0.65 hub diffusion factor stators with single boundary layer bleed slots was measured. In addition, the vane static pressure distributions were obtained at three radial locations. Overall and blade element performance was obtained for the rotor, at varying rates of vane bleed flow. Preliminary discussions of test results and correlations of data are presented. Author

N69-23768*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE AND EVALUATION OF A LIQUID-METAL PUMP FOR MERCURY SERVICE
Sol H. Gorland, Roy A. Lottig, and Thomas P. Hecker Washington May 1969 14 p refs
(NASA-TM-X-1766) Avail: CFSTI CSCL 13I

An induction-motor-powered centrifugal pump operated successfully for 1455 hr at a mercury loop at 350° to 400°F (450 to 480 K) without maintenance. Approximately 1325 hr were at the steady-state condition of 11 570 lb/hr (5250 kg/hr) flow with a head of 83.2 ft (249 J/kg). Polyphenyl-ether-lubricated ball bearings were used in the pump. Author

N69-24091*# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
BELLOWS SEALS FOR LIQUID METAL SYSTEMS: LITERATURE SEARCH FOR FABRICATION AND OPERATIONAL EXPERIENCE
R. C. Aungst Nov. 1968 31 p refs
(Contract AT(45-1)-1830)
(BNWL-905) Avail: CFSTI

The conceptual design of the control system for the Fast Test Reactor (FTR) proposes a bellows seal to isolate the drive mechanism from the Na. The seal separates the pure inert gas surrounding the drive mechanism from the mixture of Na vapor and inert gas covering the 1200°F Na pool in the reactor vessel. Seals of this type have been used in previous liquid metal systems. A search of the literature has been made to determine operating experience and provide specifications for procurement of a metallic bellows seal to meet FTR criteria. Author (NSA)

N69-24100*# Techtran Corp., Glen Burnie, Md.
ZONE CONDENSATION AS A PURIFICATION METHOD [ZONNAYA KONDENSATSIYA KAK METOD OCHISTKI]
B. V. Karasev et al. Washington NASA Apr. 1969 6 p refs Transl. into ENGLISH from Vestn. Mosk. Univ. (Moscow), no. 2, 1968 p 84–87
(NASw-1695)
(NASA-TT-F-12234) Avail: CFSTI CSCL 13H

A method is described for the preparation of purified substances based on the transfer of the initial substance in the mobile condensation zone of a tube apparatus by this process called zone condensation. Purification can be carried out either in a carrier gas flow or in a vacuum. This method has certain advantages over those presently used for the purpose of producing pure and super-pure materials. The data derived from the application of this method for the purification of several substances is summarized. The results indicate that the zone condensation process may find application in the production of a large category of pure and super-pure materials. Author

N69-24133# Royal Aircraft Establishment, Farnborough (England).
MANUFACTURING METHODS FOR CONICAL GAS BEARINGS
D. Faddy and T. L. Ellis Jul. 1968 27 p ref
(RAE-TR-68180) Avail: CFSTI

The development of methods of manufacture of conical gas bearing surfaces on a cylindrical grinding machine is described. The work is principally directed towards reducing the cost of gas bearings for precision gyroscopes, but has application to bearings for other purposes. The results of some early manufacturing trials are discussed and means for further simplifying the manufacturing method are suggested. Author (ESRO)

N69-24186# Case Western Reserve Univ., Cleveland, Ohio. Div. of Chemical Engineering Science.
DESIGN OF INLET DISTRIBUTORS FOR CHROMATOGRAPHIC COLUMNS
William Neil Musser Aug. 1968 235 p refs
(Contract AT(11-1)-1605)
(TID-24834; RR-14) Avail: CFSTI

A number of techniques for obtaining a uniform distribution of the solute pulse over the bed cross section were investigated experimentally. The velocity distribution was found to be poor for packed inlet cones. The use of high-solidity wire gauzes was found to be an attractive possibility. In inlet cones of high divergence, a solid disc placed near the inlet further improved the distribution. Dispersion in these inlets was estimated using certain modeling techniques. The reduction of the volume of the inlet device was found to be a more important design objective than the reduction of the second moment of the residence time distribution. An inlet distributor was developed, which has good distribution and very low dispersion. The dispersion was estimated to be as low as that for the packed inlet. Further the dispersion is expected to be nearly independent of column diameter so that the performance of this design in larger diameter columns should be better in all respects than that of the alternative designs considered. Author (NSA)

N69-24288*# Radio Corp. of America, New York.
WATER COOLED CONTRACTOR FOR ANODE IN CARBON ARC MECHANISM
Ronald E. Enstrom, inventor (to NASA), and William F. Schecht, inventor (to NASA) Issued 18 Feb. 1969 (filed 17 Feb. 1967) 4 p Cl. 314-129
(NASA-Case-XMS-3700; US-Patent-3,428,847; US-Patent-Appl-SN-617783) Avail: US Patent Office CSCL 13I

The operational life of contacting devices for carbon arc rod holders suitable for use in high intensity, arc type illumination systems may be extended by utilizing a resiliently biased, radially expansible, three jaw configuration having silver-tungsten contact inserts secured to hollow housings. Inlet and outlet fluid conduits are provided for each hollow housing for flushing liquid coolant. Official Gazette of the U.S. Patent Office

N69-24269# Elliott Bros., Ltd., London (England). Space and Weapons Research Lab.
REPORT ON THE VACUUM EVALUATION OF MINIATURE BEARINGS FOR SPACE APPLICATIONS
Paris ESRO Jun. 1968 39 p refs
(Contract ESTEC-446/67AA)
(ESRO-CR-3) Avail: CFSTI

The work entailed in this project constituted the preparation of test bearings, construction of two ultra-high vacuum test rigs and measuring equipment, and a programme of vacuum life-testing and evaluation of friction torque performance. Both types of test bearing, tool steel and carbon-chrome steel, ran for the required total life period, 10^5 revs, without seizure. Post test examination showed that all bearings were in good conditions at the end of the test period. Author (ESRO)

N69-24270# Elliott Bros., Ltd., London (England). Space and Weapons Research Lab.
REPORT ON THE VACUUM EVALUATION OF SLIP RINGS AND BRUSHES FOR SPACE APPLICATIONS
Paris ESRO Mar. 1968 52 p ref
(Contract ESTEC-416/67SL)
(ESRO-CR-1) Avail: CFSTI

The work entailed in this project constituted the construction of a test assembly mounted in an ultrahigh vacuum chamber containing two slip rings with a pair of brushes on each, and a programme of vacuum life-testing during which friction, wear and electrical noise were evaluated. The operating conditions were defined on the basis of a possible requirement for slip rings to transmit electrical power from rotating sun paddles. Both brush materials ($NbSe_2$ and MoS_2) survived the life test with insignificant wear. In respect of friction performance it was not possible to separate the behaviour of the two materials in vacuum, but from the independent measurements in air it is believed that the MoS_2 material gives a much lower stiction/friction ratio than does $NbSe_2$. The results obtained in this short investigation are promising, but there is evidently a need to separate the performance of each brush material by independent test running. Author (ESRO)

N69-24273# European Space Research and Technology Centre, Noordwijk (Netherlands).
PROCEEDINGS OF THE SIXTH ESRO SUMMER SCHOOL ON ENVIRONMENTS AND THEIR ROLE IN SPACECRAFT TECHNOLOGY. VOLUME 5: SATELLITE RELIABILITY [LES CONDITIONS D AMBIANCE ET LEURS INCIDENCES DANS LA TECHNOLOGIE DES VEHICULES SPATIAUX. VOL. 5: FIABILITE DES SATELLITES]
M. J. Downey Paris ESRO Jan. 1969 42 p refs Conf held at Noordwijk, Netherlands, Aug.–Sep. 1968
(ESRO-SP-44) Avail: CFSTI

This document is one of a series of publications (SP-40 to SP-51) covering the lectures given at the sixth ESRO Summer School held in Noordwijk (Netherlands) in 1968. The present lecture constitutes an introduction to the many work areas associated with a Satellite Reliability Programme. A brief description is given of such activities as satellite reliability prediction, failure mode analysis, parts and materials programme, satellite reliability evaluation, etc. Quality assurance is discussed in a similar manner so that a comprehensive picture is gained of the effort necessary to ensure the success of a satellite mission. (ESRO)

N69-24319*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIRECT RADIATION COOLING OF THE COLLECTOR OF LINEAR BEAM TUBES
Lloyed J. Derr, inventor (to NASA) Issued 4 Feb. 1969 (filed 18 Apr. 1967) 5 p Cl. 313-44
(Contract NAS7-100)
(NASA-Case-XNP-9227; US-Patent-3,426,230;
US-Patent-Appl-SN-632164) Avail: US Patent Office CSCL 13I

In a linear beam tube the normal electron beam collector is thermally isolated and made of small mass so that it is heated to incandescense by the impacting electron stream. The heated collector is made parabolic in shape to produce a favorable unidirectional heat radiation pattern and is positioned near the end of the tube opposite the cathode end. Said collector is oriented to radiate its heat out of the tube's envelope through a vacuum tight window which in this case has good heat transmitting properties, thereby cooling the collector electrode without special cooling means. The collector also includes a reflector, so positioned with respect to the parabolic section, that most of the heat from the collector is radiated towards the window either directly from the collector or the reflector. As a result about 80% of the heat generated by the thermal conversion is radiated out of the tube.
Official Gazette of the U.S. Patent Office

N69-24320*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT BATTERY SEALS
Karl F. Plitt, inventor (to NASA), and Carroll H. Clatterbuck, inventor (to NASA) Issued 11 Feb. 1969 (filed 1 Sep. 1966) 5 p Cl. 136-133
(NASA-Case-XGS-3864; US-Patent-3,427,205;
US-Patent-Appl-SN-577114) Avail: US Patent Office CSCL 13I

A battery seal is used to insulate a terminal of an inverted T-shape. The terminal extends through a flat cover plate of the battery and is insulated from the plate by the seal having a rubberized characteristic. The insulation comprises two parallel washers above and below the plate joined by a hollow conical section that protrudes through the plate. The terminal leg fits inside this section with insulation extending around the periphery of the cross member by the bottom washer, and means are provided to create a pressure seal between the insulation and the plate. The terminal is thereby insulated from the casing and internally forming dendrites.
Official Gazette of the U.S. Patent Office

N69-24322*# McDonnell Aircraft Corp., St. Louis, Mo.
METHOD FOR MAKING A HEAT INSULATING AND ABLATIVE STRUCTURE
Clive A. Newcombe, inventor (to NASA), and John H. Proemsey, inventor (to NASA) Issued 4 Feb. 1969 (filed 11 Feb. 1965) 6 p Cl. 156-242
(NASA-Case-XMS-1108; US-Patent-3,425,885;
US-Patent-Appl-SN-432032) Avail: US Patent Office CSCL 13A

A procedure is described for filling a honeycomb matrix with deserated paste filler for the construction of ablative heat shields for spacecraft. The matrix is subjected to a vacuum to evacuate the air from the cells of the matrix; the paste filler is injected into the evacuated cells; pressure is applied to the paste to insure complete filling; the vacuum is released; and finally, the resultant structure is heated and allowed to cool.
Official Gazette of the U.S. Patent Office

N69-24358*# Electric Storage Battery Co., Raleigh, N. C. Esch Missile and Electronics Div.
DEVELOPMENT OF IMPROVED PLATELOCK FOR MARINER TYPE SEALED AgO-Zn CELLS, PART 2, 20 AUGUST 1968–10 JANUARY 1969
C. D. Farris 10 Jan. 1969 39 p ref Prepared for JPL
(Contracts NAS7-100; JPL-951927)
(NASA-CR-100781; E-2-69-Pt-2) Avail: CFSTI CSCL 11A

Development of an improved platelock, consisting of an organic compound which will not react with the negative plate in sealed Mariner cells to produce excessive pressure during charged stand at 140°F is discussed. Cells containing the previous platelock, Bondmaster 639/CH2, passed the vibration profile but failed the 14-day charged stand at 140°F due to excessive pressure. ESB investigated eleven different epoxy systems as platelocks singly and the components and additives of each singly in sealed Mariner cells during 14-day charged stand at 140°F. In these tests, curing agents for epoxy systems were responsible for more excessive cell pressure, more ABS cell jar attack and more decay of open circuit voltage than either the mixed epoxy systems or uncured resins. Catalyst #927 and Catalyst #11 produced less cell pressure and were less reactive in contact with ABS cell jars than the other catalysts tested. Author

N69-24370# Army Electronics Command, Fort Monmouth, N. J.
CONTROLLED ATMOSPHERE FIRING FOR FORMATION OF BARRIER-LAYER DIELECTRICS
Howard Wichansky Nov. 1968 18 p refs
(AD-680193; ECOM-3044) Avail: CFSTI CSCL 13/8

A new process was devised for producing barrier-layer dielectrics from high purity barium titanate. The process developed permits the formation of a dielectric with high capacitance per unit volume by a one-fire treatment with the use of controlled atmosphere in place of three separate firings presently required. A barrier-layer dielectric was produced that had a capacitance of 3400 picofarads in a bulk volume of 0.0062 cu in and dissipation factor of 0.035 at 1 kHz and room temperature. The capacitor demonstrated only a 20 percent decrease in capacitance with a 300-volt d.c. applied potential. Author (TAB)

N69-24442# Army Electronics Command, Fort Monmouth, N. J.
PROCESSES AND TECHNIQUES FOR FABRICATION OF MAGNETIC PLATED WIRE
William L. Wade, Jr. and Gordon C. Sands Oct. 1968 23 p refs
(AD-680191; ECOM-3029) Avail: CFSTI CSCL 13/8

The report details a facility for the fabrication of quality permalloy plated wires for computer memory applications. A description of the sequence of steps for a continuous plating system is included. Related parameters pertinent to production of reproducible uniform films and reduction of mechanical stresses are discussed; e.g. both composition, thickness, substrate surface, memory element, analytical techniques, electrolytic cleaning, and electropolishing. The fabrication of instrumentation necessary for measurement of switching time is described briefly. Author (TAB)

N69-24500*# Stanford Research Inst., Menlo Park, Calif.
DEVELOPMENT OF TECHNIQUES TO IMPROVE BLADDER MATERIALS AND TEST METHODS, ADDENDUM 1 Final Technical Report, Aug. 1968–Mar. 1969
R. F. Muraca, J. S. Whittick, and A. A. Koch 30 Mar. 1969 30 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951484; SRI Proj. PRD-6068)
(NASA-CR-100779) Avail: CFSTI CSCL 13H

Equivalent polytetrafluoroethylene (PTFE) films for expulsion bladders can be made from aqueous dispersions obtained from different suppliers without alteration of the process parameters developed previously. The flex resistance of the PTFE films is not affected by prolonged immersion in N_2O_4. The micro crease tester was rebuilt from metals that are compatible with N_2O_4 as well as OF_2, and the loading system was redesigned to provide smoother and more accurate performance at a constant tension. The results of a comprehensive and critical literature review indicate the feasibility of cladding titanium alloys with an electroless nickel plate to protect them from impact sensitivity in the presence of OF_2 or possible hydrogen embrittlement in the presence of B_2H_6; a program of development for such a plate is outlined. Author

N69-24639# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
ENDURANCE OF BONDED SOLID LUBRICANT FILMS
J. E. Houghton Nov. 1968 23 p refs
(RD/B/N-1186) Avail: AEC Depository Libraries

The frictional behavior of thin films of graphite, MoS_2, WS_2, and metal-free phthalocyanine, each bonded using sodium silicate, was investigated over the temperature range from 20 to 800°C in a dry carbon dioxide atmosphere. The reliability of such films was found to be superior to that of unbonded films; this is attributed to more effective utilization of film surface area resulting from greater film thickness. Temperature limitations imposed by lubricant oxidation were found to be less stringent than previously thought, the binder apparently inhibiting oxidation. The first three of the bonded films are suitable for use in many reactor mechanisms. Author (NSA)

N69-24682# Boeing Co., Renton, Wash. Commercial Airplane Div.
CALCULATION OF THE COEFFICIENT OF PERFORMANCE OF A VAPOR CYCLE REGRIGERATION SYSTEM
O. E. S. Svensson Oct. 1968 29 p refs
(AD-680592; D6-20409-3TN) Avail: CFSTI CSCL 13/1

The technical note describes the refrigeration vapor cycle analysis based on use of equations for representing the thermodynamic properties of the refrigerant. The SPOT computer program calculates the coefficient of performance of a typical refrigeration system. The refrigerants that can be handled by the program are Freon -11, -12, -21, and -114, and it can easily be modified to handle other refrigerants. Author (TAB)

N69-24699# Naval Civil Engineering Lab., Port Hueneme, Calif.
HIGH EXPANSION FOAM FIRE PROTECTION SYSTEMS
Allan S. Hodgson Feb. 1969 21 p refs
(AD-682928; NCEL-TN-1016) Avail: CFSTI CSCL 13/12

An investigation has been made regarding the suitability of high expansion foam fire protection systems for use in Naval shore facilities. Certain types of storage facilities and remote buildings requiring self-contained systems are typical locations where high expansion foam should be considered for fire protection. Author (TAB)

N69-24731# Mechanical Technology, Inc., Latham, N. Y.
LIQUID METAL BEARINGS TECHNOLOGY FOR LARGE, HIGH TEMPERATURE SODIUM ROTATING MACHINERY Progress Report, 1 Aug.–31 Oct. 1968
E. B. Arwas, L. Hoogenboom, C. Kissinger, F. K. Orcutt, and W. D. Waldron Jan. 1969 39 p refs
(Contract AT(30-1)-3930)
(NYO-3930-3; MTI-69-TR-1) Avail: CFSTI

The analysis and computation procedures necessary to prepare the design data for large sodium lubricated bearings operating in the turbulent inertial flow regime was completed. Calculations to optimize shrouded step bearing configurations for operation with low viscosity lubricants (such as liquid sodium) and under high levels of turbulence were studied. Development of proximity (film-thickness) measuring transducers suitable for operation in high-temperature, liquid sodium ambient was started. The development of the film pressure measurement transducers for operation in high temperature sodium was completed. A sample probe is being subjected to fatigue testing to evaluate the ability of the transducer, including its diaphragm and coated surface to withstand large, cyclic pressure changes, when the probe is installed in a rotating journal, to scan the circumferential pressure profile in the bearing. Author (NSA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 28 Physics, Solid State.

N69-23408 Utah Univ., Salt Lake City.
A STUDY OF A CONTINUOUS WAVE VOLTAGE-TUNABLE OPTICAL PARAMETRIC OSCILLATOR
Edwin George Cheffee (Ph.D. Thesis) 1968 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-14433

The design of a continuous-wave voltage-tunable optical parametric oscillator is considered. Two crystals of potassium dihydrogen phosphate are used in the system, one which doubles the frequency of an argon laser to provide an ultraviolet pump frequency, and the other which is used as the nonlinear element in a parametric oscillator. The threshold power for the oscillator is calculated for an arrangement in which the oscillator cavity is situated inside the pump cavity. For the parameters chosen the pump cavity output power must be 1 watt to achieve threshold oscillations. The effect of simultaneously resonating the fundamental and second harmonic waves within separate cavities shows that enhancements of harmonic power of 10^6 times over that for a single pass may be possible. Dissert. Abstr.

N69-23931# Northronics, Palos Verdes Peninsula, Calif.
RESEARCH ON DIRECT NUCLEAR PUMPING OF GAS LASERS (DNPCL) Final Report, May 1966–Dec. 1968
James R. Rusk, Richard D. Cook, Josef W. Eerkens, James A. Juren, and Bert T. Davis Dec. 1968 109 p refs
(Contract AF 33(615)-5000)
(AD-680406; NORT-67-267; AFAL-TR-68-258) Avail: CFSTI CSCL 20/5

Nuclear stimulation of emission in noble gases was investigated. The gases were contained in a cylinder lined with U(235)O2 or B(10) and closed with confocal end mirrors. The cylinder was irradiated in the core of a TRIGA Reactor. Fission fragments from the cylinder wall ionized the gases and effectively pumped the gases to metastable states required for laser action.

Total light output was determined using a silicon PIN detector. Spectral measurements were made with a grating spectrograph. Spectral lines were observed at the wavelengths observed in ionic lasers pumped by conventional means. Specifically, a strong line was observed at 668.4 nm corresponding to singly ionized Argon.
Author (TAB)

N69-23965*# RCA Service Co., Inc., Seabrook, Md.
LASER/GRARR COLLOCATION EXPERIMENT
Paul A. Maresca *In* Commun. and Systems, Inc. Proc. of the GEOS Program Rev. Meeting, Vol. 3 Feb. 1968 p 59-64 (See N69-23961 12-07)
(Contract NAS5-10600)
Avail: CFSTI CSCL 20E

As part of the GEOS-1 observations systems intercomparison investigation, several groups of tests were conducted from July 1966 through November 1966 at Rosman, N. C. These tests consisted of side-by-side tracking of the GEOS-1 spacecraft by the Goddard Range and Range Rate system and the Goddard laser tracking system. The primary purpose of the collocated tracking was the comparison of the accuracy of the two systems involved. A byproduct of the intercomparison was the determination of the effectiveness of the laser as a calibration instrument for electronic tracking systems. Seventeen satellite passes were tracked by the laser and were used in the intercomparison described in this report.
Author

N69-24181*# Stanford Univ., Calif. W. W. Hansen Labs. of Physics.
INVESTIGATION OF LASER DYNAMICS, MODULATION AND CONTROL BY MEANS OF INTRA-CAVITY TIME VARYING PERTURBATION Semiannual Status Report, 1 Aug. 1968-31 Jan. 1969
S. E. Harris Feb. 1969 17 p refs
(Grant NGR-05-020-103)
(NASA-CR-100748; ML-1724; SASR-6) Avail: CFSTI CSCL 20E

The work under this grant is generally concerned with the generation, control, and stabilization of optical frequency radiation. In particular, we are concerned with obtaining tunable optical sources by means of nonlinear optical techniques. We have proposed and begun work on a new type of electronically tunable optical filter. The basic idea is to make use of acousto-optic diffraction in an anistropic optical media. We expect that bandwidths a few angstroms wide which are completely tunable over the visible spectrum may be attained.
Author

N69-24221# Institut fuer Plasmaphysik G.m.b.H., Garching (West Germany).
FOCUS DETECTOR AS AN AID FOR FOCUSING A LASER ON A TARGET [EIN FOKUSDETEKTOR ALS HILFSMITTEL BEI DER FOKUSSIERUNG EINES LASERS AUF EIN TARGET]
K. Buechl Dec. 1968 15 p refs In GERMAN; ENGLISH Summary
(IPP-3/82) Avail: CFSTI

An apparatus is described which assesses the focus of a laser on a surface. An image of the focus is scanned by fiber optics. A moving slit together with a photodetector behind the fibers detects whether a fiber is illuminated or not. When the focus coincides with the surface of the target, the number of illuminated fibers is a minimum. The apparatus is especially advantageous for adjustment when the radiation is not visible, for example, with neodymium lasers or with frequency doubled radiation from ruby lasers.
Author

N69-24471# Army Electronics Command, Fort Monmouth, N. J.
CHEMICAL MIXTURES IN SUBMILLIMETER LASERS
George E. Morris, Charles S. Brand, Harold Jacobs, and Thomas R. Mooney Oct. 1968 28 p refs
(AD-680192; ECOM-3039) Avail: CFSTI CSCL 20/5

A study is made on the operating characteristics of the HCN laser when various chemicals are added to the basic fuel CH3CN. Laboratory tests are reported in which NH4OH and CO2 are added in a controlled manner and show improvements in total output power and/or lower threshold currents for oscillation.
Author (TAB)

N69-24580# Temple Univ. Research Inst., Philadelphia, Pa.
INVESTIGATION OF SEVERAL HIGH TEMPERATURE REACTIONS INVOLVING CYANOGEN AND LIKE COMPOUNDS AS HIGH BRIGHTNESS CHEMICAL PYROTECHNIC SOURCES Summary Report, 2 Jan. 1964-1 Aug. 1968
C. S. Stokes and L. A. Streng Aug. 1968 107 p
(Contract DA-36-034-AMC-0246(A))
(AD-680293; RITU-1968-18) Avail: CFSTI CSCL 20/5

The use of a cyanogen-oxygen gaseous detonation system has been demonstrated successfully to pump both neodymium and ruby solid state lasers. Several types of pumping fixtures have been evaluated and the energy input in terms of radiation temperature have been correlated to mixture ratio, initial pressure, ignition geometry, and vessel geometry. A complete study of the radiation output of the cyanogen-oxygen gaseous detonation system including the effect of inert gas addition (helium, argon and xenon) was undertaken. The radiation temperature of the cyanogen-oxygen detonation using 52% cyanogen with the initial system pressure at 3 atm was 6300K. The use of inert additives yielded temperatures as high as 8000K. Emission spectra were taken of the detonation together with detonation velocity measurements.
Author (TAB)

N69-24661# Institute for Defense Analyses, Arlington, Va.
TRANSIENT EFFECTS IN SIMULATED RAYLEIGH SCATTERING
Norman M. Kroll Jun. 1968 29 p refs
(Contract DAAC15-67-C-0011)
(AD-680598; RR-P-435; IDA/HQ-68-8940) Avail: CFSTI CSCL 20/6

A transient analysis of laser-induced forward scattering instabilities is presented with emphasis upon heat-deposition-induced stimulated Rayleigh scattering. The theory presented provides a link between previously presented instability analyses in the short-pulse and steady-state limits. It is shown that the time required to reach the steady state is of the order of the reciprocal line width of the material excitation multiplied by the total gain.
Author (TAB)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N69-23388 Lehigh Univ., Bethlehem, Pa.
PRECIPITATION STUDIES OF Pb AND Se IN PbSe SINGLE CRYSTALS
Halle Abrams (Ph.D. Thesis) 1968 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-15890

The kinetics of precipitation in PbSe was studied as a function of the species precipitating, the precipitation temperature and the properties of the host lattice (i.e., the dislocation density). This was accomplished by performing electrical measurements, such as the Hall effect, resistivity and Seebeck effect as a function of time and temperature. The precipitation kinetics can be described by the following equation: $f(t) = 1 - \exp(-(t/\tau)^n)$, where the time constant τ, and the power dependence n provide useful information about the rate limiting process involved, and the size, shape and density of the precipitate particles. For the initial stage of precipitation of Pb in PbSe an average value of $n = 1.12$ was experimentally determined. This value of n is indicative of spherically shaped precipitate particles, especially if pre-precipitation exists. Dissert. Abstr.

N69-23430# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EDDY CURRENT TEST PATTERN RECOGNITION PROGRAM
R. N. Ord and R. L. Richardson Nov. 1968 48 p
(Contract AT(45-1)-1830)
(BNWL-942) Avail: CFSTI

The size and shape of a test pattern generated by an eddy current probe passing a flaw defect in metal tubing presents an opportunity to classify flaw patterns using automated techniques. The first step in this direction was the development of a mathematical model making use of the first two statistical moments to correlate an unknown pattern with a standard set of known patterns. Twelve of the 20 patterns selected at random were identified with the standard set of 23 patterns. The accumulation of experience with this process will lead to an improved set of standard patterns and consequent improvement in random pattern identification. The ultimate goal of this program will be the development of a test box for field use which will be used for eddy current incipient failure testing. Author (NSA)

N69-23468*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIGMA PHASE FORMATION AND ITS EFFECT ON STRESS-RUPTURE PROPERTIES OF IN-100
Robert L. Dreshfield and Richard L. Ashbrook Washington Apr. 1969 26 p refs
(NASA-TN-D-5188) Avail: CFSTI CSCL 11F

Three IN-100 compositions, sigma free to very sigma prone, were made by adding aluminum and titanium to one master heat. At 1550°F (843°C), the sigma free alloy had no sigma after 5000 hours; the very sigma prone alloy formed sigma in less than 24 hours. Sigma prone alloys had rupture lives as low as 10 percent of that expected for sigma free alloys in sigma forming, temperature–time realms. Sigma phase had no discernible effect on rupture ductility. The use of time–temperature parameters in sigma forming alloys was analyzed. Author

N69-23588 Rensselaer Polytechnic Inst., Troy, N. Y.
SINTERING OF SILVER PARTICLES IN THE HOT STAGE OF AN ELECTRON MICROSCOPE
Gernot Gessinger (Ph.D. Thesis) 1968 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-13511

In this investigation, sphere on sphere model sintering experiments were performed without an external load. Micron size spheres of atomized silver powder were supported by a thin carbon film and sintered at almost constant temperature in the hot stage of an electron microscope. The geometry changes during sintering were recorded for each run by a series of electron micrographs. It was observed from the photomicrographs, that the configurational changes that take place during the sintering of such small particles, vary over a wide range from one run to another. At a given neck radius the degree of center to center approach varies from zero to the maximum possible theoretical value. Due to the experimental method of continuous observation of each run a series of geometric observations was made possible for the first time. Dissert. Abstr.

N69-23673# Scientific Research Atomic Reactor Inst., Melekess (USSR).
THE METALLIC BERYLLIUM BEHAVIOUR IN SM-2 REACTOR [POVEDENIE METALLICHESKOGO BERILLIYA V REAKTORE SM-2]
Z. I. Chechetkina, V. P. Gol'tsev, F. I. Grechishkin, S. N. Votinov, V. A. Tsykanov et al 1968 19 p refs In RUSSIAN
(SRARI-F-20) Avail: AEC Depository Libraries

After irradiation in the SM-2 Reactor, metallic beryllium was investigated to evaluate its radiation damage and determine its safety lifetime. Corrosion resistance, mechanical properties, dimensional stability, and structural changes were studied according to the irradiation dose and fission gases (helium and tritium) buildup. The effect of some technological factors on beryllium radiation stability was also considered. Some recommendations on beryllium use are given for the conditions analogous to SM-2 Reactor. Author (NSA)

N69-23674# Illinois Univ., Urbana.
ATOMIC MECHANISMS DURING THE ANNEALING OF IRRADIATED METALS
J. S. Koehler Sep. 1968 18 p refs Presented at Intern. Conf. on Vacancies and Interstitials in Metals, Juelich, Germany, 23–28 Sep. 1968 (COO-1198-585; Conf-680910-4) Avail: CFSTI

Unresolved problems associated with annealing stages I and II are described. Evidence which supports the assignment of state III annealing in irradiated gold and aluminum to vacancy migration is described. Electron microscope pictures of interstitial clusters in electron irradiated gold observed below stage III are described. It is shown that the interaction between interstitial clusters and migrating vacancies reduces the number of jumps to annihilation by a factor of thirty to sixty in aluminum and gold. Possible reasons for the second order annealing kinetics are examined. Remaining problems in copper and silver are mentioned. Author (NSA)

N69-23675# Kernforschungszentrum, Karlsruhe (West Germany).
MULTI-AXIAL IN-REACTOR STRESS-RUPTURE STRENGTH OF STAINLESS STEELS AND A NICKEL-ALLOY
H. J. Laue, H. Bohm, and H. Hauck Aug. 1968 14 p refs Presented at the Symp. on Radiation Effects in Reactor Metals, San Francisco, 23–28 Jun. 1968
(KFK-814; EURFNR-686; EUR-3972; Conf-680604-9) Avail: Issuing Activity

The stress-rupture strength and tangential rupture strain of the stainless steels $^{16}/_{13}$ CrNi and $^{20}/_{25}$ CrNi, Inconel 625, and Incoloy 800 cladding materials were determined under irradiation between 600 and 700°C. The irradiations were performed in the Belgian Reactor BR2 with a fast neutron flux between 2.5 and

4.0 × 10^{14}n/cm^{2}sec. The stress-rupture strength was reduced between 20 and 50% by irradiation. The highest decrease was measured on the complex alloys Inconel 625 and $^{16}/_{13}$ CrNi. The tangential rupture strain was reduced to absolute, values of 1%, with exception of the Ti- and Al-free Incoloy 800 (2.5 to 4.7%). NSA

N68-23681# Bettis Atomic Power Lab., Pittsburgh, Pa.
EFFECTS OF PRESSURE UPON THE CORROSION OF ZIRCALOY-4 (LWBR DEVELOPMENT PROGRAM)
S. Kass Oct. 1968 30 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-782) Avail: CFSTI

Experiments were performed in high-temperature water and steam to evaluate the long-term corrosion performance of Zircaloy 4. Tests in 750°F steam at three different pressures showed increasing amounts of corrosion with decreasing steam pressure. The pressure dependence of the corrosion rate was noted to be negligible after short exposure periods, but the total amount of corrosion products produced was appreciably different and continuously diverging after extended exposures. Similarly, the times to transition as well as the transition weight gain values showed tendencies to increase with decreasing steam pressure. Altering the steam pressure in the 750°F steam tests did not produce any transient or long-time effects upon corrosion, and the behavior subsequent to a pressure change was found to be consistent with that noted under constant pressure conditions. Tests in 680°F water at 1500 psi and in 680°F steam at 1500 psi also showed that the amount of corrosion product is pressure dependent; more corrosion occurs in water than in steam. Author (NSA)

N68-23695# Oak Ridge National Lab., Tenn.
POSTIRRADIATION TENSILE AND CREEP-RUPTURE PROPERTIES OF SEVERAL EXPERIMENTAL HEATS OF INCOLOY 800 AT 700 AND 760°C
D. G. Harman Dec. 1968 31 p refs
(Contract W7405-ENG-26)
(ORNL-TM-2305) Avail: CFSTI

Tensile and creep-rupture data have been obtained at 700° and 760°C for several experimental heats of Incoloy 800 that were irradiated in the ORR at elevated temperatures. Effects of composition, grain size, and carbide morphology were investigated. Enhanced postirradiation ductility was achieved for Incoloy 800 containing about 1.0% Ti in creep-rupture tests. The maximum ductility for this composition was obtained for the smaller grain sizes and at the lower creep stress levels and appeared to be independent of carbon content. Significant variations in properties were noted for alloys within the commercial Incoloy 800 composition specifications. Author (NSA)

N69-23731*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CREEP-RUPTURE DATA FOR WELDED N-155 TUBES
Richard E. Morris Washington May 1969 31 p refs
(NASA-TN-D-5195) Avail: CFSTI CSCL 11F

Creep rupture pressure tests were conducted to obtain creep deformation and lifetime data for use in the design of a helium-to-air heat exchanger with a 10,000 hour life for nuclear airplane application. Design curves are presented for 2 percent strain, 5 percent strain, and rupture in a graph of stress against Larson-Miller parameter. Creep strength of the tubes was about 2/3 of the sheet strengths given in handbooks. Tube strength was limited by the strength of the weld. Thermally cycled specimens had approximately 10 percent lower strength and higher average equivalent bore strains than specimens tested at constant temperature. Author

N69-23770# California Univ., Livermore. Lawrence Radiation Lab.
THE DIFFUSION OF IRON IN α-Fe-Si ALLOYS
D. Y. F. Lai and R. J. Borg 3 Oct. 1968 7 p refs
(UCRL-50516) Avail: CFSTI

The diffusion coefficient of iron was determined by a tracer method in α-Fe–Si alloys. The composition dependence of activation energy and diffusion was measured over almost the entire phase field. Author (NSA)

N69-23794# National Lead Co. of Ohio, Cincinnati. Technical Div.
ELEVATED-TEMPERATURE MECHANICAL PROPERTIES OF URANIUM WITH VARIOUS PROCESSING HISTORIES
L. G. Wexlin Dec. 1968 30 p refs
(Contract AT(30-1)-1156)
(NLCO-1009) Avail: CFSTI

Specimens for mechanical testing were prepared from standard production uranium in the cast, extruded, and rolled conditions. Some of the metal of each type was beta heat treated. The mechanical properties investigated were: tensile, tensile impact, drop hammer, hardness, and compression. The tests were conducted at temperatures ranging from 885 to 1235°F. A few tests were made at higher temperatures. Author (NSA)

N69-23837# Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.
THERMALLY ACTIVATED DEFORMATION IN DILUTE ZIRCONIUM-OXYGEN ALLOYS
P. Das Gupta and V. S. Arunachalam 1968 26 p refs
(BARC-344) Avail: CFSTI

The effect of temperature and strain-rate on the yield and flow stress of zirconium containing oxygen in the range of 0.09% to about 2.5% has been examined at temperature between 77°K and 700°K. The measurements were coupled with strain-rate change tests and stress relaxation experiments so that all the deformation parameters associated with thermal activation could be evaluated. The results of these measurements showed that the thermal component of flow stress was increasing with increasing oxygen content of the alloy. Two stages of activation were found to occur for all these alloys. The first stage was associated with the unpinning of dislocation loops from impurity pinning points. At higher temperatures, because of the unpinning of many impurity pinning points, a second stage of activation associated with a different mechanism was found to occur. The variation of certain parameters associated with this stage of deformation strongly suggests the P-N force as the controlling criterion. Author

N69-23846# Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.
INFLUENCE OF TEXTURE ON THE MECHANICAL PROPERTIES OF ZIRCALOY 2 CONTAINING STRESS-ORIENTED HYDRIDES
T. K. Sinha and V. S. Arunachalam 1968 21 p refs
(BARC-367) Avail: CFSTI

Results of room temperature tensile tests show that there is reduction in strength and ductility of Zircaloy-2 when hydrides are oriented perpendicular to stress axis; this reduction is more drastic in the case of specimens having high basal pole density along the stress axis compared to specimens having prism texture. An interpretation based on the availability of habit planes suitably oriented along the intergranular boundaries, is advanced to explain the loss in ductility. The role of intragranular hydrides during stress-orientation has also been considered. Author

N69-23852# Los Alamos Scientific Lab., N. Mex.
COMPILATION OF CALCULATED DATA USEFUL IN PREDICTING METALLURGICAL BEHAVIOR OF THE ELEMENTS IN BINARY ALLOY SYSTEMS
E. T. Teatum, K. A. Gschneidner, Jr., and J. T. Waber 24 Dec. 1968 206 p refs Supersedes LA-2345
(Contract W-7405-eng-36)
(LA-4003; LA-2345) Avail: CFSTI

Physicometallurgical data have been computed for all the binary combinations of elements in the periodic table with the exception of the halogens, rare gases, and those elements having atomic numbers higher than that of americium. Brief descriptions are given of the formulae for the following quantities: the radius ratio, the sublimation energy ratio, the Mott bonding number, the Hildebrand or heat of mixing factor, and the electronegativity difference. Some possible uses of these quantities are also described. The sources of data selected for the calculations and the arrangement of the tables are discussed. Author (NSA)

N69-23867# Los Alamos Scientific Lab., N. Mex.
MEASUREMENT OF CARBON GRADIENT IN STAINLESS STEEL BY He-3 ACTIVATION AND AUTORADIOGRAPHY
Jack L. Parker and Dale M. Holm Apr. 1968 9 p refs
(Contract W-7405-eng-36)
(LA-4008) Avail: CFSTI

A method combining activation by ^{3}He irradiation with autoradiographic techniques was demonstrated to give good measurements of both carbon concentration and carbon gradients in stainless steel. Carbon in the surface of the sample is first activated by the $^{12}C(^{3}He, ^{4}He)^{11}C$ reaction (^{3}He energy of $\simeq$6.5 MeV. Autoradiographs of the activated surface are then made, the exposure being mainly by the positrons from the decay of the ^{11}C. Densitometric analysis of the autoradiographs together with a measurement of the ^{11}C activity induced in the sample and a knowledge of reaction cross section, particle range, and other parameters are used in the computations. The technique is applicable to the determination of carbon distributions in matrices with $Z \geq 25$. Author (NSA)

N69-23924# Bettis Atomic Power Lab., West Mifflin, Pa.
METALLOGRAPHIC STUDY OF BREAK-AWAY DURING THE OXIDATION OF ZIRCONIUM
L. H. Keys, G. Beranger, B. De Gelas, and P. Lacombe [1968] 27 p refs Transl. into ENGLISH from J. Less-Common Metals (Netherlands), no. 14, 1968 p 181–200
(WAPD-Trans-0092) Avail: CFSTI

The kinetics of the oxidation of zirconium in oxygen at elevated temperatures are characterized by the transition from a quasiparabolic rate law to an apparently linear law for longer oxidation durations. Together with the occurrence of this kinetic transition, a continuous modification in the morphology of the oxide film leading to the break-away of the film is observed. A study of the structural changes of the oxide formed during the oxidation in the temperature range 700° to 1050°C has been performed by metallography; the occurrence of fissuring in the oxide film and the separation of a white oxide film from the black, metal-adherent oxide are shown and discussed especially in connection with the relative mechanical properties of the oxide and of the metal substrate. The various experiments described have led to a suggested mechanism for the break-away phenomenon. Author (NSA)

N69-23957# Institut fur Plasmaphysik G.m.b.H. Garching (West Germany).
ON THE RECOVERY OF ION-BOMBARDED METAL SURFACES [ZUM AUSHEILVERFAHREN IONENBESCHOSSENER METALLOBERFLAECHEN]
H. Vernickel Oct. 1968 25 p refs In GERMAN; ENGLISH summary Presented at the 15th Field Emission Symp., Bonn, Sep. 1968 Sponsored by EURATOM
(IPP-2/72) Avail: CFSTI

Activation energies for recovery of ion bombarded tungsten and molybdenum surfaces were measured using field emission techniques. After bombardment at 100°K, extended annealing was evidenced; for tungsten it occurred between 100° and 900°K with activation energies between 0.2 and 2 eV, and for molybdenum between 100° and 750°K with activation energies of 0.2 and 1.5 eV. Small bombardment caused annealing of tungsten surfaces mainly in two stages around 0.3 and 1.5 eV; a large dose blurred the structure of the annealing curves. It is noted that annealing began below room temperature. Author

N69-24189*# Techtran Corp., Glen Burnie, Md.
THE QUESTION OF MICROHARDNESS OF THE OXIDES OF CERTAIN ELEMENTS [K VOPROSU O MIKROTVERDOSTI OKISLOU NEKOTORYKH ELEMENTOV]
L. N. Bazhenova et al Washington NASA Apr. 1969 8 p refs Transl into ENGLISH from Neorganicheskiye Mater. (USSR), v. 2, no. 11, 1966 p 1991–1997
(Contract NASw-1695)
(NASA-TT-F-12249) Avail: CFSTI CSCL 11F

The hardness of the oxides of metals and certain other elements is examined on the basis of changes in electron structure. The hardness of certain oxides is measured and an attempt is made to interpret the data obtained from the point of view of the features of the electron structure of these compounds. It is shown that the hardness of oxides is governed by the probability of the formation of stable electron configurations by the atoms of metals and oxygen. A reduction in the statistical weight of stable configurations of both components or one of them results in an increase in the proportion of nonlocalized electrons and in a corresponding decrease in hardness. Author

N69-24272# Danish Research Centre for Applied Electronics, Copenhagen.
FLUIDS FOR TECHNICAL WELDING OF PRINTED CIRCUIT BOARDS. AN INVESTIGATION OF SOLDERING ABILITY, CORROSIVITY AND METHODS OF CLEANING [FLUSMIDLER TIL MASKINEL LODNING AF PRINTPLADER. EN UNDERSOGELSE AF LODDEEVNE, KORROSIVITET OG METODER FOR AFRENSNING]
S. T. Olesen Sep. 1968 49 p In DANISH; ENGLISH summary
(ECR-03) Avail: CFSTI

This project includes solder-fluxes for industrial soldering of printed-circuit boards, on soldering machine or by manual dipsoldering. Furthermore a number of organic solvents for removal of fluxresidues are examined. Seven different solvents and nineteen different fluxes of English, German, American, and Danish manufacture are examined in order to determine, soldering ability, corrosivity, and insulation resistance for the fluxes, and the cleaning ability for the solvents. The tests include both weakly and strongly activated types of fluxes, in order to examine advantages and disadvantages of both types. This is necessary as the advantage of high soldering ability for strongly activated types are sometimes compensated by a greater corrosivity and lower insulation resistance. Supplementary tests include a number of secondary process factors among which may be mentioned the tinquality of the component terminals, oxidation as a consequence of storage, the soldering temperature, the thickness of flux layer, the presence of solderable protection varnish and the factors connected with the cleaning procedure. Author (ESRO)

N69-24275# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPARISON OF METHODS OF SEPARATING PHASES IN NICKEL-CHROMIUM ALLOYS
N. I. Blok et al Feb. 1968 13 p refs Transl. into ENGLISH from the book "Spektralnye i Khimicheskie Metody Analiza Materyalov, Sbornik Metodik" Metallurgizdat., Moscow, 1964 p 78-83
(AD-682767; FTD-HT-23-1061-67) Avail: CFSTI CSCL 11/6

An examination was made of almost all the proposed electrolytes for the separation of the intermetalide and carbon phases in the alloys Ni-Cr-Ti-Al, and the best of them are pointed out. Author (TAB)

N69-24280# Institutt for Atomenergi, Kjeller (Norway).
THE EFFECT OF ELECTRICAL FIELD STRENGTH IN THE OXIDE FILM ON THE INITIATION OF PITTING IN SUPER PURE ALUMINUM
Ketil Videm [1967] 23 p refs Presented at CITCE Colloq. on Corrosion and Electrochem. Thermodyyn., Istanbul, Sep. 1967
Avail: CFSTI

The development of corrosion pits consists of two different steps: initiation and growth. Experiments regarding the initiation of pits are difficult to interpret when they are carried out as straight exposure in a corrosive environment, even under controlled electrochemical conditions, because the local breakdown of the oxide takes place in a film of rather undefined thickness and structure. This was overcome in the present experiments by using anodizing in ammonium tartrate to apply well defined film prior to the exposure in the chloride bearing environment. The thickness of the film was determined by capacity measurements after the dielectric constant was determined by combined electric and ellipsometric measurements. The second (pit-forming) exposure was carried out under potentiostatic conditions at field strength lower than those giving rise to film growth. Breakdown of the oxide film led to a sharp increase in the current and the time for it was noted. For a given chloride content a certain electrical field strength was required for a fast initiation of pits. Author

N69-24291# Notre Dame Univ., Ind. Dept. of Metallurgical Engineering and Materials Science.
STRAIN ENERGY AND MESTABILITY OF 3-DIMENSIONAL DISLOCATION ARRAYS Final Report
Charles W. Allen 1 Aug. 1968 18 p refs
(Grant AF-AFOSR-809-65)
(AD-680029; AFOSR-68-2882) Avail: CFSTI CSCL 11/6

A summary is given of a program which concentrated on three-dimensional dislocation arrays and has utilized high speed numerical computation to determine stored elastic energy associated with various arrangements of screw dislocations in space. The major portion of the experimental program has concentrated on the relationships which exist among stacking fault energy, cross-slip, the onset of dislocation substructure formation, and the microscopic deformation characteristics of polycrystalline metals and alloys. Author (TAB)

N69-24314# Central Mechanical Engineering Research Inst., Durgapur (India).
EFFECTS OF VARYING DEGREES OF POROSITY IN WELDS ON ULTRASONIC PULSE ECHO INDICATIONS
S. G. N. Swamy and P. C. Mahajan Oct. 1968 15 p refs
(A18) Avail: CFSTI

Experimental observations on the effect of varying degrees of porosity in steel butt welds on ultrasonic pulse echo indications are reported. An attempt has been made to analyze and interpret the results in terms of equivalent radiographic standards of the International Institute of Welding. Results are illustrated by actual echo patterns. Good correlation has been estsblished with radiographic and macrostructure studies. Author

N69-24338# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
DYNAMIC TESTING AND WAVE PROPAGATION IN A STRAIN RATE SENSITIVE MATERIAL
Hal Watson, Jr. Dec. 1968 30 p refs
(Contract N00014-68-A-0515)
(AD-680247; Themis-SMU-TR-21) Avail: CFSTI CSCL 11/6

Short specimens of Armco iron were tested at room temperature under compressive, axial loads at strains up to 0.8 percent and strain rates up to 1000 in/in-sec. During loading, the axial stress was measured with a thin, piezoceramic disk inserted between the specimen and loading bar. The surface strain was measured with conventional epoxy-backed, foil strain gages, and the strain rate deduced by differentiating the strain vs. time record. The stress, strain, and strain rate data were plotted and were found to be approximated by a particular constitutive functional. The constitutive equation was then used along with the governing equations of motion and continuity in finding a numerical solution to the problem of a one-dimensional plastic wave propagating in a rate sensitive bar caused by an initial axial stress sigma (0,t). The solutions at two locations for both stress and strain were found to compare favorably with the stress and strain measured in a long bar impact test. Author (TAB)

N69-24345# Army Materials and Mechanics Research Center, Watertown, Mass.
THERMAL, OPTICAL, AND ELECTRICAL PROPERTIES OF TUNGSTEN AND SILVER INVESTIGATED BY CLASSICAL ELECTROMAGNETIC THEORY
Albert F. Grenis Oct. 1968 20 p refs
(AD-680189; AMMRC-TR-68-20) Avail: CFSTI CSCL 11/6

An analytical study was made of the interrelation of thermal, optical, and electrical properties for the refractory metal tungsten and for the noble metal silver. Data available in the technical literature, together with extrapolation techniques, were employed within a framework of mathematical equations (derived from Maxwells electromagnetic equations and associate optical equations) to obtain supplementary data over a wide range of frequencies and temperatures. Thermophysical properties of interest included the thermal radiation constant, such as the normal spectral emissivity; the optical constants, such as the refractive index and absorption coefficient; and the electrical constants, such as the electric conductivity and electric permittivity. Author (TAB)

N69-24371# Atomics International, Canoga Park, Calif.
DIFFUSION BONDING OF TITANIUM ALLOYS Final Report
C. A. Smith Watertown, Mass. Army Mat. Res. Agency Jun. 1968 27 p refs
(Contract DA-19-066-AMC-339(X))
(AD-680213; AI-68-73; AMRA-CR-66-10/1-F) Avail: CFSTI CSCL 11/6

The report discusses diffusion bonding experiments performed on Ti-6Al-4V to study the effect of temperature, pressure, and surface finish on bond strength for several bonding times. Good bonds were obtained, as measured by shear tests, at a temperature of 1440F on samples with a 15 micro-in. finish with a pressure of 400 psi applied for 60 min. The shear test was used to give a simple and accurate measure of bond strength. In addition, ultrasonic methods and metallography were used to give a qualitative indication of bond integrity. Author (TAB)

N69-24373# TRW, Inc., Cleveland, Ohio.
INFLUENCE OF ALLOYING ELEMENTS ON THE TOUGHNESS OF LOW ALLOY MARTENSITIC HIGH STRENGTH STEELS Final Technical Report, Jul. 1967-Sep. 1968

C Visheysky and E. A. Steigerwald Watertown, Mass. Army Mat. and Mech. Res. Center Nov. 1968 107 p refs
(Contract DAAG46-67-C-0171)
(AD-680298; ER-7217-1; AMMRC-CR-68-09(F)) Avail: CFSTI CSCL 11/6

The study examined the effects of various elements on the notch bend fracture toughness and Charpy impact behavior of a 0.35%C, 3%Ni, Cr-Mo-V martensitic steel having a room temperature yield strength of approximately 160-180 ksi. A classical approach was used in the design of alloys which permitted a direct evaluation of single element effects rather than interactions. The elements C, Mn, Si, Cr, and Mo raised both the notch bend fracture mode transition temperature and the Charpy V-notch transition temperature (100% fibrosity criterion). In amounts above that required for deoxidation and grain refinement aluminum degraded the transition temperature and toughness slightly. A minimum toughness occurred at a vanadium content of 0.1%. Over the entire range of compositions examined (1.26 - 6.23%) nickel decreased the transition temperature and improved toughness at the lower test temperatures. Charpy shelf energy, C sub v (max), and fracture toughness K sub max (at 75F), did not correlate well with work hardening exponent (n). Good agreement was obtained however when these parameters were plotted versus true fracture strain. At -321F, toughness was essentially fracture strain independent suggesting that a critical strain criterion based on fracture strain is valid only when fracture is fibrous. A comparison was made of measured K sub 1c calculated from tensile data. The results indicated that the increased contribution on non-ductile fracture which accompanies increases in strength and/or decreases in test temperature in low alloy steels can lead to large errors in the predicted toughness. Author (TAB)

N69-24395# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
PAR AND DIELASTIC MODULUS CHANGES OF ALUMINUM AFTER REACTOR IRRADIATION AT 4.6°K [PAR- UND DIELASTISCHE MODULAENDERUNG VON ALUMINUM NACH REAKTORBESTRAHLUNG BEI 4,6°K]
Franz Kerscher (Ph.D. Thesis) 1968 84 p refs In GERMAN
Avail: CFSTI

Polycrystalline aluminum of high purity was examined for changes in the moduli and for recovery annealing as compared with changes in the residual electrical resistivity. The inner friction and the shear modulus of the material were determined by measuring the logarithmic decrement and the duration of the free vibrations of a coil spring. A resistance sensor of the same material, placed concentrically to the spring, was used to measure at the same time the resistivity and the defect concentration. Seven radiation-induced friction peaks were observed, which were attributed to the thermally activated reorientation of anisotropic point defects under the influence of external tensile stress. By measuring the inner friction at two different frequencies, it was possible to obtain the activation enthalpies for the relaxation processes. A model is proposed for the recovery of radiation-induced defects based on findings regarding the reactions of certain defect types in the metal lattice. Transl. by K.W.

N69-24478# Technische Hochschule Munchen (West Germany).
STRENGTH DETERMINATIONS BY STATIC BENDING TEST ON CASE-HARDENED STEEL 18 NiCrMo 14 AFTER CARBURIZATION AND CARBONITRATION IN A GAS ATMOSPHERE [FESTIGKEITSUNTERSUCHUNGEN IM STATISCHEN BIEGEVERSUCH AM EINSATZSTAHL 18 NiCrMo 14 NACH AUFKOHLUNG UND KARBONITRIERUNG IN EINER GASATMOSPHAERE]
Hans-Joseph Laudenberg (Ph.D. Thesis) 19 Jul 1967 130 p refs In GERMAN
Avail: CFSTI

A theory for gaseous carburization and gaseous carbonitration is outlined and temperature effects on steel tempering processes are evaluated by examining bending resistance of nickel-chromium-molybdenum steel. Blank hardened samples of fully carburized and surface carburized steels are studied by undergoing static bending tests and the effects of austempering temperatures and duration, starting temperatures, and duration, carbon content, carbonization depths, and annealing treatment on their fracture resistance were observed. An optimal temperature treatment range was established. Transl. by G.G.

N69-24580# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE HIGH-TEMPERATURE STABILITY OF THORIA-STRENGTHENED NICKEL-CHROMIUM ALLOYS
Louis Raymond and Joachim P. Neumann 23 Dec. 1968 34 p refs
(Contract F04701-68-C-0200)
(AD-680389; TR-0200(4250-10)-7; SAMSO-TR-68-442) Avail: CFSTI CSCL 11/6

Two nickel-base, 20% chromium - 2% thoria alloys, manufactured by different techniques, were studied with regard to their response to high-temperature exposure. Both alloys retained their dislocation substructure after 1-hr annealing treatments up to 1800F. Annealing above this temperature resulted in a decrease in room temperature hardness of one of the alloys, while the other retained its original hardness and remained microstructurally stable up to 2400F. The decrease in hardness was associated with a decrease in the dislocation density and an increase in grain size. The thoria particles in the stable alloy had an average diameter of 550 A, as compared to 820 A for the less stable alloy. It appears that the difference in the particle sizes accounts for the difference in the structural stability at elevated temperatures. Author (TAB)

N69-24657# Oak Ridge National Lab., Tenn.
A BIBLIOGRAPHY ON TRACER DIFFUSION IN METALS. PART 5: SELF AND IMPURITY DIFFUSION IN SIMPLE METAL OXIDES
John Askill, comp. Jan. 1968 11 p refs
(Contract W-7405-eng-26)
(ORNL-3795-Pt-5) Avail: CFSTI

Frequency factors and activation energies for self and impurity diffusion in simple metal oxides have been compiled from the literature reported up to December 1966. An autor index is included. Author (NSA)

N69-24588# California Univ., La Jolla. Dept. of Aerospace and Mechanical Engineering Sciences.
THE LATERAL DEFLECTION OF A CIRCULAR RING PLATE BUCKLED BY A CLOSING MOMENT
Francis E. Vanalager Nov. 1968 28 p refs
(Contract N00014-67-A-0109)
(AD-680248; TR-26) Avail: CFSTI CSCL 11/6

This paper presents a numerical solution to the nonlinear von Karman plate equations. The particular problem considered is the axisymmetric lateral buckling of a circular ring plate having a ratio of the radii of 2 and a Poissons ratio of 0.3. This problem corresponds to the lateral buckling of a complete ring under a closing moment, i.e., a moment tending to deform the plate into a ring of smaller radius. The equations are written in finite difference form, and an iterative technique is used to obtain the nonlinear solution. The results show that, for this particular case, the initial stage of post-buckling deformation is stable and does not exhibit any snap-through type of instability. This result is in agreement with experimental observations previously reported. Author (TAB)

N69-24811# Stanford Univ., Calif. Dept. of Genetics.
THE VARIABLE CORROSION RESISTANCE OF 18 CR-8NI STAINLESS STEELS: 1. BEHAVIOR OF COMMERCIAL ALLOYS
Byron E. Wilde and Norbert D. Greene Mar. 1968 22 p refs
(Contract Nonr-591(17))
(AD-680038; TR-5) Avail: CFSTI CSCL 13/8

The electrochemical and corrosion characteristics of Types 303, 304 and 316 stainless steel in 1N H2SO4 were determined using precision potentiostatic polarization and conventional coupon exposure/weight change techniques. Factors increasing the magnitude of the critical anodic current density, Ic, are shown to have a deleterious effect on the passivating tendencies of Type 304 alloys. Statistical analysis of the electrochemical properties of Type 304 alloy has shown that Ic is related to chemical constitution by the following relationship: Ic = 15471 + 373 (Mn) - 1240 (Cu) - 750 (Mo) + 76000 (S) - 6500 (C) - 840 (Cr). Control of the detrimental effects of sulphur and manganese in Type 304 alloys can be obtained during manufacture by increase in copper and molybdenum content. Author (TAB)

N69-24833# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF FRICTION UNDER UNSTEADY, HIGH-SPEED CONDITIONS
V. M. Goryunov May 1968 12 p refs Transl. into ENGLISH from the Russian
(AD-680578; FTD-HT-23-1488-67) Avail: CFSTI CSCL 11/6

The aim of the investigation was a study of the temperature conditions, the friction and wear characteristics, and the nature of the wear for a number of alloys and metals at sliding speeds of the order of 220 meters/sec and higher. The friction unit used is shown schematically. This unit made it possible to investigate simultaneously the friction of two samples, identical in construction, but which could be different or the same in material. Author (TAB)

N69-24665# Panametrics, Inc., Waltham, Mass.
MECHANISMS OF KRYPTON RETENTION BY METALS IN RELATION TO CORROSIVE STUDIES Final Report
Richard H. Maehl, O. Cucchiara, and Philip Goodman Dec. 1968 28 p refs
(Contract N00014-68-C-0265)
(AD-680460) Avail: CFSTI CSCL 11/6

Radioactive Kr85 may be introduced into solids under the influence of a voltage gradient or by a pressure, temperature biased diffusion process. Suggestions are made for methods of studying stress corrosion by means of Kr behaviors in metals. Author (TAB)

N69-24697# Army Materials and Mechanics Research Center, Watertown, Mass.
ANODIC POLARIZATION OF TITANIUM AND ITS ALLOYS IN HYDROCHLORIC ACID
Milton Levy and Gilbert N. Sklover Nov. 1968 15 p
(AD-682740; AMMRC-TR-68-22) Avail: CFSTI CSCL 11/6

Commercially pure titanium and the alloys studied exhibited active to passive transitions in HCl. Increasing the acid concentration increased the critical current for passivity and shifted the critical potential for passivity in the noble direction. Increasing the temperature served only to increase the critical current for passivity. Activation energies for the anodic polarization process were the right order of magnitude for a reaction controlled by reactivity at the metal surface. For the alpha-beta alloy 6Al-6V-2Sn the critical current for passivity increased as the ratio of amounts of beta-to-alpha phase decreased with increasing strength level. The addition of Fe(3+) and Cu(2+) (0.03 M) to the HCl facilitated passivation of the metal and its alloys. The maximum dissolution current densities for the metal and alloys in HCl were double those in H2SO4. Pitting of several of the alloys occurred in HCl but not in H2SO4. Author (TAB)

N69-24705# Battelle Memorial Inst., Columbus, Ohio.
PLASTIC FLOW IN THE LOCALE ON NOTCHES AND CRACKS IN Fe-3SI STEEL UNDER CONDITIONS APPROACHING PLANE STRAIN Final Report
G. T. Hahn and A. Rosenfield Nov. 1968 63 p refs
(Contract Nobs-92383)
(AD-680123; SSC-191) Avail: CFSTI CSCL 11/6

The development of the plastic zones generated by sharp through-cracks and blunter notches was studied systematically in plates of Fe-3Si steel. A sensitive etching technique revealed the plastic zone both on the plate surface and on parallel and normal interior sections. In addition, the progress of through-the-thickness deformation was followed by monitoring normal displacements at the plate surface. Author (TAB)

N69-24738# Naval Research Lab., Washington, D. C.
DYNAMIC TEAR TEST DEFINITION OF THE TEMPERATURE TRANSITION FROM LINEAR ELASTIC TO GROSS STRAIN FRACTURE CONDITIONS
F. J. Ross and W. S. Pellini Nov. 1968 21 p refs
(AD-680600; NRL-6787) Avail: CFSTI CSCL 11/6

Transition temperature concepts for fracture-safe design have been based on the relatively narrow temperature range evidenced by the fracture-mode transition from plane strain to plane stress. Fracture mechanics theory has suggested that large increases of section size should provide sufficient mechanical constraint for retention of plane strain conditions through the transition temperature range. Recent investigations based on dynamic tear (DT) tests of thick-section reactor-grade steels (A-533 B) have provided clear evidence that the plane strain to plane stress transition is not eliminated. The DT test, as conducted using a small specimen, defines the temperature range of transition from linear elastic to gross strain mechanical conditions of fracture and, therefore, the required analytical treatment for flaw size-stress calculations. Fracture mechanics concepts are brought into consonance with transition temperature concepts of long standing, and the importance of considering fracture initiation in terms of limiting dynamic toughness values is emphasized. Author (TAB)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N69-23418*# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF THE KINETICS OF CRYSTALLIZATION OF MOLTEN BINARY AND TERNARY OXIDE SYSTEMS Quarterly Status Report, 1 DEC. 1968-28 FEB. 1969

James F. Bacon 1 Apr. 1969 33 p refs
(Contract NASw-1301)
(NASA-CR-100695; H910373-14; QSR-14) Avail: CFSTI CSCL 11B

Twenty-five new glass compositions were originated, prepared, and partially characterized in this period. Similar characterization measurements comprising density, Young's modulus, and fiberizability measurements were completed for some of the compositions reported earlier. At the time of this report, a total of eleven glass compositions were developed with values for Young's modulus in excess of twenty million psi and another two dozen with values for Young's modulus lying between eighteen and twenty million psi. Possibly the most significant of these glasses is UARL 350, which while not having the highest value for Young's modulus, since it has a Young's modulus of 19.8 million psi, has a specific modulus of 197 million inches. These values can perhaps best be interpreted by comparison with other common structural materials. Experiments on the fiberization of these new glasses are not yet complete. At report time the best data on the experimental glass compositions in fiber form is for UARL 331 which gave a value for Young's modulus of 19.8 million psi and a specific modulus of 150 million inches. Author

N69-23447*# McDonnell-Douglas Astronautics Co., Santa Monica, Calif.
EXPERIMENTAL INVESTIGATION OF ULTRAHIGH VACUUM ADHESION AS RELATED TO THE LUNAR SURFACE Quarterly Progress Report, 1 Jan.–31 Mar. 1969
J. J. Grossman and J. A. Ryan 15 Apr. 1969 26 p refs
(Contract NAS7-307)
(NASA-CR-100694; A-13P-681; QPR-17) Avail: CFSTI CSCL 11B

The distribution of charge on vacuum cleaved albite was measured and found to be a simple dipole, reproducible on cleaving the same crystal twice. An orthoclase crystal was left in the vacuum chamber for 76 days the longest run to date. The adhesion force to an aluminum plate was found to have decreased, linearly, to approximately one-third its initial value when plotted as adhesion force verses log t. Chemical etching, photomicrographic, and microchemical techniques are being developed to study the defect structure of a series of possible lunar silicates. This will help in identifying effects of the lunar environment on their surface and structural properties. Author

N69-23501# Georgia Univ., Athens. Dept. of Physics.
INFRARED SPECTRA OF PLASTICS AND ELASTOMERS AFTER NUCLEAR IRRADIATION Research Report for 1968
W. C. Sears 20 Dec. 1968 17 p refs
(Contract AT(40-1)-2418)
(ORO-2418-6) Avail: CFSTI

Since molar absorptivity for the trans-vinlene band in trans-1,4-polybutadiene was found to decrease as its temperature increases, several temperature cycles on new samples of this polymer and one on cis-1,4-polybutadiene have been caried out. Trans-1,4-polybutadiene, on being melted before spectral scanning, continued to show a change of crystallinity from modification I to II at 57 to 58°C instead of 76°C as was previously determined. A change in slope of the molar absorptivity cure versus temperature curve for the trans polymer was observed at 76°C, but no rapid drop in molar absorptivity or integrated intensity was found near the melting point at 145°C. This effect is attributed to rapid cooling which apperently kept the polymer amorphous. Resolution of recorded polymer spectra into component bands is being done by a computer to get a more accurate measure of ban intensities prior to analysis calculations. Author (NSA)

N69-23701*# North American Rockwell Corp., Anaheim, Calif. Autonetics Div.
POLYMERIC FILMS FOR SEMICONDUCTOR PASSIVATION
S. M. Lee Mar. 1969 60 p
(Contract NAS12-2011)
(NASA-CR-86139) Avail: CFSTI CSCL 11C

Test results demonstrate that Parylene functions as an excellent barrier coating material for semiconductor devices. Extended electrical stressing at 175°C indicated that no failures occurred when any of the three Parylenes were used as coatings on reliability chips (Rel-chip). The performances of Parylene-coated MOS FET's on the Rel-chip were compared to those made by the standard canned process under the following stress conditions: (1) increasing temperature storage; (2) −25 volts on the P–regions; (3) −20 volts on the P–regions and +20 volts on the gate; and (4) no stress (control). All stressed devices were exposed for 16 hours consecutively at 100°, 125°, 150°, 175°C, and finally 128 hours at 175°C. The most sensitive electrical parameters of the MOS FET's were measured after each of the above thermal and electrical stresses. The results indicate that changes in the electrical parameters were negligible on most of the devices after they were subjected to the various stress conditions. Vacuum deposition equipment for Parylene was designed and fabricated. Then a series of experiments using Parylene C, D, and N were conducted to optimize coating process variables on several different types of substrates. Thickness measurements were made after coating at various locations throughout the chamber. Very clear films were prepared of uniform thickness and free from unreacted dimer. A satisfactory technique for the application of pinhole-free coatings of Parylene was achieved. Author

N69-23758# California Univ., Berkeley. Lawrence Radiation Lab.
CONDUCTIVITY AND ELECTRODE POLARIZATION IN MOLTEN SODIUM DISILICATE GLASS CONTAINING IRON
Richard Norman Schweinberg (M.S. Thesis) Apr. 1968 44 p refs
(Contract W-7405-eng-48)
(UCRL-18200) Avail: CFSTI

Sodium disilicate glasses with 0 to 20% FeO additions were studied at 1000° to 1100°C under constant dc and ac potentials. The drop in current with time under a dc potential was recorded with iron electrodes and the concentration distributions that resulted from ionic movement were analyzed using the electron microprobe. Iron entered from the anode by replacement of fast-moving sodium ions. Near the cathode, a cloud of metallic sodium was formed and iron dendrites grew from the electrode into the glass. Alternating current frequency ranges of 0.5 to 50 kc and initial dc peak currents were investigated to give total current readings. Blocking electrodes such as gold and platinum were used at the anode in order to obtain the electronic current. Increasing FeO contents increased both the ionic and electronic contributions to the conductivity. The steady-state composition in the glass at the anode and the mobility of the anode cation appears to be the controlling factors in molten glasses in determining the nature of polarization and ionic conduction. Author (NSA)

N69-23795# Oak Ridge National Lab., Tenn. Solid State Div.
BIBLIOGRAPHY OF SECOND AND THIRD ORDER ELASTIC CONSTANTS
Herbert Pomerance Dec. 1968 27 p refs
(Contract W-7405-eng-26)
(ORNL-RMIC-9) Avail: CFSTI

A bibliography of 196 references is presented on second and third order elastic constants of monocrystalline materials compiled from Physics Abstracts and the files of the Research Materials Information Center literature since 1964. The materials are arranged alphabetically by chemical symbol. Included with the symbols are the crystalline form where it is not cubic, temperature and pressure ranges of the measurements, the alloying percentages, and the reference number. NSA

N69-23843*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

A BONDING MATERIAL FOR OPTICALLY IMMERSING INFRARED DETECTORS FROM 2 TO 14 MICROMETERS

Richard D. Packard Washington May 1969 15 p refs

(NASA-TM-X-1776) Avail: CFSTI CSCL 11A

The visible and infrared transmitting properties of a specific epoxy resin are analyzed and shown to be suitable for bonding infrared detectors, operating in the 2–14 μm spectral region, to an optically transmitting substrate for immersed applications. Additionally, this resin permits preliminary system alignment using visible radiation. The resin also has desirable physical properties for such bonding applications. Author

N69-23865*# Boeing Co., Seattle, Wash. Aerospace Group

IN SITU ELECTRON, PROTON, AND ULTRAVIOLET RADIATION EFFECTS ON THERMAL CONTROL COATINGS Final Report, 1 Sep. 1965–15 Jul. 1968

Lawrence B. Fogdall, Sheridan S. Cannaday, and Richard R. Brown Jul. 1968 149 p

(Contract NAS5-9650)

(NASA-CR-100146) Avail: CFSTI CSCL 11C

Measurements of spectral reflectance in the wavelength region from 240 to 2500 millimicrons were obtained in situ on a total of about 200 samples, before exposures began, periodically during exposures, and both in vacuum and in air, following exposures. Data obtained from these measurements were analyzed for spectral reflectance changes, for solar absorptance changes, for irradiation rate effects, and for synergistic effects. The program has resulted in many significant results and conclusions. The specular surfaces tested and the leafing aluminum–silicone coating tested are relatively hard to reflectance degradation under 50-keV electron exposure. Excepting leafing aluminum, the diffuse coatings or paints tested are subject to severe, in-air recoverable degradation in the infrared wavelength region, and to substantial visible region, reflectance losses which are less recoverable or bleachable upon reexposure of test samples to air. Coatings employing methyl silicone binders sustain the greatest degree of reflectance degradation in the infrared wavelength region. Author

N69-23935# Naval Research Lab., Washington, D. C.

FRACTURE TOUGHNESS OF CERAMIC MATERIALS USING THE SINGLE-EDGE-NOTCHED SPECIMEN

Karl R. McKinney Sep. 1968 15 p refs

(AD-680612; NRL-1931) Avail: CFSTI CSCL 11/2

The possibility of using the single-edge-notched specimen for fracture toughness testing of ceramic materials has been investigated. Five materials were used in this study as follows: borosilicate glass, magnesia, alumina A, alumina B, and crystalline glass. For three of the materials, where the data of other investigators were readily available, good agreement was obtained. Author (TAB)

N69-24344# Aberdeen Proving Ground, Md. Army Coating and Chemical Lab.

RELIABILITY OF THE TEMPERATURE-FLOW-CORROSION UNIT IN ANTIFREEZE STUDIES Progress Report

James H. Conley and Arthur B. Krawinghaus Nov. 1968 28 p refs

(AD-680186; CCL-254) Avail: CFSTI CSCL 11/7

The purpose of the investigation was to determine the reliability of the Temperature-Flow-Corrosion Unit (TFCU) in obtaining heat transfer data and corrosion data on antifreeze compounds. Test conducted in this study employed antifreeze meeting Federal Specification O-A-548a with added Federal Specification O-1-490a inhibitor. Quantitative metal ion concentration was determined by an atomic absorption spectrophotometer. Oscillographic scanning of the wave forms produced by the electronic power unit under load indicate a fallacy in the volt meter and ammeter scale readings. The results show that the use of the TFCU for heat transfer properties of antifreeze compounds is not feasible due to the fact that they do not necessarily correlate with results produced in an automotive cooling system. The results also indicate that a loss in thermal conductivity resulting from corrosion product deposition on a metal surface can be overshadowed by the effect of increased surface roughness on fluid turbulence. Resultant heat transfer rates can increase as the corrosion products are deposited. Author (TAB)

N69-24386# Army Weapons Command, Rock Island, Ill. Science and Technology Lab.

THE DEVELOPMENT OF FLAME RESISTANT, HEAT SEALABLE COATED FABRICS FOR ARMY WEAPONS APPLICATIONS

Allan C. Saunders Oct. 1968 24 p refs

(AD-680188; RIA-68-2400) Avail: CFSTI CSCL 11/5

Fires originating from incendiaries, flame throwers and the use of highly combustible fuels have brought about a greater renewed effort by industry and the military for the use of flame resistant coated fabrics. A research study was initiated wherein a total of five varieties of commercially available coated fabrics, two substrates, five polymers, six flame retardants and nine commercially fabricated polyethylene/vinyl acetate coatings, modified for flame resistance, were investigated for the purpose of obtaining an improved flame resistant, heat sealable coated fabric. Author (TAB)

N69-24390*# IIT Research Inst., Chicago, Ill. Technology Center.

DEVELOPMENT OF S-13G-TYPE COATINGS AS ENGINEERING MATERIALS Final Report, 1 Sep. 1968–30 Aug. 1968

R. O. Rogers and G. A. Zarlaut 5 Mar. 1969 78 p refs Prepared for JPL

(Contracts NAS7-100; JPL-951737; ITTRI Proj. 46053)

(NASA-CR-100771; IITRI-U6053-11) Avail: CFSTI

The generic identification, S-13G, is specifically related to the stabilized S-13 zinc oxide-pigmented RTV-602 paint developed as a replacement for an earlier S-13 coating whose optical properties were not adequate under ultraviolet exposure. When manufactured in four gallon production quantities, the shelf life and optical stability problems were solved by pigment and paint manufacturing process changes involving: (1) employment of one additional redispersion (resulting in a total of four); (2) use of 1% solutions of sodium acid phosphate, NaH_2PO_4, as the wash in the last two redispersions, and (3) use of 1% zinc silicate based on the weight of silicated pigment in the paint formula. The resulting paint possesses a shelf life in excess of three months and cures to an elastomeric adherent film when processed with a specified commercial catalyst and primer. Eight-mil films have a nominal solar absorptance of 0.20 and a nominal total hemispherical emittance of 0.88. An engineering value of 0.02 is recommended to account for the increase in solar absorptance from space ultraviolet irradiation. In addition, the application parameters of the paint are described in detail when subjected to cryogenic temperatures in vacuum conditions. A.C.R.

N69-24587# Brown Univ., Providence, R. I. Div. of Applied Mathematics.

AN EXPERIMENTAL INVESTIGATION OF THE DYNAMIC TANGENT MODULI OF POLYETHYLENE

James P. Walsh Aug. 1968 106 p refs

(Contract DA-31-124-ARO(D)-358)

(AD-680202; DA-358/8; TR-8) Avail: CFSTI CSCL 11/9

The research presented in this thesis is on the study of the behavior of the dynamic tangent moduli of polyethylene under large quasi-static deformations. This involved both the determination of the complex shear modulus G* and the complex Youngs modulus E* as a function of longitudinal and torsional strains. Author (TAB)

N69-24630# California Univ., Livermore. Lawrence Radiation Lab.
CONTROLLED-TRANSIENT TECHNIQUE FOR MEASURING RADIATION-INDUCED CONDUCTIVITY IN DIELECTRICS
John H. Winslow 8 Oct. 1968 15 p refs Presented from Conf. on Elec. Insulation and Dielectric Phenomena, Buck Hill Falls, Pa. (Contract W-7405-eng-48)
(UCRL-71353; Conf-681026-1) Avail: CFSTI

Radiation-induced conductivity in dielectrics was studied using the behavior of polyethylene and polystyrene during irradiation. Measurements were made under constant irradiation (about 50 rad/sec ^{60}Co gammas) with electric fields limited to the range below about 50 kV/cm. The two materials were found to display a type of volume photoconductivity which may be useful in examining conduction mechanisms and related internal phenomena. Mechanisms responsible for observed currents are not obvious, but they are shown to be insensitive to trace elements and minor constitutents. Small sensitivity to neutron bombardment suggests structural imperfections present in large concentration. NSA

N69-24631# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.
IDENTIFICATION OF SIZES, FINISHES, OR TREATMENTS ON GLASS FIBERS BY PYROLYSIS-ATTENUATED TOTAL REFLECTANCE INFRARED SPECTROSCOPY
Leonard R. Weiner Dec. 1968 53 p refs
(AD-680205; PA-TM-1849) Avail: CFSTI CSCL 11/2

A pyrolysis-infrared technique for the qualitative fingerprint identification of some low-level surface treatments on glass fibers is described. The infrared spectrum obtained by pyrolysis of the treated surface will be characteristic of the room-temperature-condensable vapors of the major component in the treatment formulation. This method is not applicable for treatments which do not produce room-temperature-condensable pyrolysis products. The simplicity, rapidity, and reproducibility of the procedure will permit the qualitative specification and control of most polymeric film formers and lubricants. However, only a few of the silane treatments used on fiberglass can be identified. Author (TAB)

N69-24721# Naval Research Lab., Washington, D. C.
MONOMOLECULAR FILMS OF POLYDIMETHYLSILOXANES ON ORGANIC LIQUIDS Interim Report
N. L. Jarvis Nov. 1968 18 p refs
(AD-680256; NRL-6780) Avail: CFSTI CSCL 7/4

A homologous series of polydimethylsiloxanes was spread as insoluble monomolecular films on water and on a number of organic liquids of varying surface tension and surface composition. The organic liquids studied as substrates were tricresyl phosphate, propylene carbonate, diethylphthalate, bis(2-ethylhexyl)adipate, and hexadecane. Monolayer stability and insolubility were found to vary with the molecular weight of the polydimethylsiloxane and the polarity of the substrate liquid. Stable, reversible monomolecular films were formed on all substrates by the higher-molecular-weight polymers (mol wt > 6000); however, film stability decreased with decreasing polymer molecular weight and decreasing substrate polarity. On tricresyl phosphate and propylene carbonate the high-molecular-weight polymers adsorbed in a fully extended configuration at large areas per molecule, analogous to their behavior on water. With compression they assumed a helical configuration with six monomer units per helix. On the less polar substrates the polydimethylsiloxanes apparently remained in the helical configuration regardless of the state of compression. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N69-23355*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON SOME NUMERICAL DIFFICULTIES IN INTEGRATING THE EQUATIONS FOR ONE-DIMENSIONAL NONEQUILIBRIUM NOZZLE FLOW
Harvard Lomax, Harry E. Bailey, and Franklyn B. Fuller Washington Apr. 1969 38 p refs
(NASA-TN-D-5176) Avail: CFSTI CSCL 12A

Several numerical difficulties arise in the problem of integrating the ordinary differential equations that represent the flow of a gas in chemical nonequilibrium through a nozzle. These difficulties are identified with parasitic eigenvalues, saddle-point behavior, and indeterminate forms. The numerical difficulties and the methods that successfully overcame them for the particular examples analyzed are discussed in this report. Author

N69-23358 Missouri Univ., Rolla.
NONPARAMETRIC SEQUENTIAL DETECTION
James Charles Fowler (Ph.D. Thesis) 1968 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-14048

This dissertation extends the theory of the Wilcoxon-Mann-Whitney U statistics, so that this statistic can be used to perform sequential tests of hypotheses. This sequential test procedure makes use of a sequential ranking procedure similar to the one first introduced by Parent. The operating characteristic function and average number of samples function for this new test are calculated as a function of the signal to noise ratio. The test is then shown to be efficient for several forms of alternatives with an efficiency of 95% against the Wald Sequential Probability Ratio Test for a constant signal in normal noise. Finally, the test procedure is modified so that it is capable of making measurements on the channel in order to adapt itself to changes in the channel characteristics. Simulation results are presented to show that this adaptive detector can operate with low probability of error. Dissert. Abstr.

N69-23360 California Univ., Berkeley.
STABILITY OF SOME NONLINEAR SYSTEMS
Naser Mostaghel (Ph.D. Thesis) 1968 73 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-13939

Liapunov's Direct Method and a linearization approach have been used in the study of stability of the system for ϕ (t) L_1 integrable, and periodic, respectively. In the former case, a sufficiency region of stability is constructed through the use of a Liapunov function. In the latter case, which is investigated by means of a linearization process, a Hill equation is obtained, whose stability is studied by a method suggested by Malkin. Malkin's method is then

modified to obtain, by use of a first approximation, the first stability region in parameter space. A second approximation is also worked out. When the approximations obtained herein for general periodic function are reduced to the special cases of the Mathieu equation and the Hill-3-term equation, the results compare very well with the available numerical results based on the exact solution of each of those equations. Dissert. Abstr.

N69-23363 California Univ., Berkeley.
PURE STRUCTURES
Michel Jean (Ph.D. Thesis) 1968 79 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-13916

A structure α is said to be p-pure, where p is a positive integer, if all substructures of α of cardinality p are isomorphic; α is pure if it is p-pure for every positive integer p; α is purely orderable if for some linear ordering S of the domain of α, (α, S) is pure. A pure type is a maximal class of pure structures which have isomorphic substructures of the same finite cardinality. It was known to R. Fraïssé since 1955 that every pure infinite structure is purely orderable. More recently C. Frasnay has shown that there are integers p and n such that every p-pure structure of cardinality $\geq$ is purely orderable. This last result can be improved in two special cases: a p-pure binary relation of cardinality n is purely orderable if $3 \leq p \leq n - 3$ and a p-pure irreflexive and symmetric relation of rank r and cardinality n is purely orderable if $r \leq p \leq n - r$. Dissert. Abstr.

N69-23364 Indiana Univ., Indianapolis.
GENERALIZED INNER PRODUCT SPACES
Donald Otto Koehler (Ph.D. Thesis) 1968 78 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-13700

This paper is based on the observation that the L^p spaces, where p is an even integer, have norms that arise from a multilinear form in much the same way that the norm of L^2 arises from a bilinear form. The L^p model suggests paralleling the use of a bilinear form in the study of an abstract inner product space with the use of a multilinear form in the study of an abstract "generalized inner product" space. Thus this paper first considers the problem of defining a generalized innner product of order 2n, and then shows that the generalized inner product does generate a norm. Several examples are considered to show the wide variety of these spaces; and it is illustrated that there are generalized inner product spaces of the same dimension that are not isometrically isomorphic to each other. Dissert. Abstr.

N69-23370 Oregon State Univ., Corvallis.
REPRESENTATIONS OF CENTRAL CONVEX BODIES
Norman Fred Lindquist (Ph.D. Thesis) 1968 62 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-14876

Some centrally symmetric convex polytopes can be represented as finite vector sums of line segments; for a three dimensional central polyhedron, this property is equivalent to the polyhedron having faces which are centrally symmetric. The dissertation treats properties of centrally symmetric convex bodies in n-dimensional Euclidean space and their relation to arbitrary (not necessary finite) vector sums of line segments. Specifically, it is shown that a convex polytope is a finite vector sum of segments if and only if its faces of some fixed dimension r, r greater than or equal 2, are finite vector sums of segments. Further, if a sequence of convex bodies which are finite vector sums of segments converge to a convex body, then that limit body is a projection body. Dissert. Abstr.

N69-23371 New Mexico State Univ., University Park.
AN INVESTIGATION OF THE EFFECTS OF COMPUTERS UPON ELEMENTARY ANALYSIS
Ray Logan Graham (Ph.D. Thesis) 1968 189 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-14697

Several prominent mathematicians have begun the writing of a calculus text that will reflect the impact of computer implementation. More "drudgery" problems will be assigned for the computer to solve, stronger intuitive motivation for concepts can be given, and the students will emerge with a different attitude toward mathematical analysis. The natural order of presentation of topics will change, new methods of problem solving will be introduced, and some standard topics such as integration by the method of partial fractions and Newton's method of finding roots may be omitted. Abstractions with no point will assume a lesser role, but abstractions per se will be strongly motivated by applications. Calculus as an introduction to higher mathematics is in for some changes, and this dissertation investigates these changes. Dissert. Abstr.

N69-23373 Dartmouth Coll., Hanover, N. H.
SPLITTING FIELDS OF ORTHOGONAL GEOMETRIES
James Samuel Jantosciak (Ph.D. Thesis) 1968 60 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-14834

Let V be a finite dimensional vector space over the field k (characteristic not two). Give V a nonsingular orthogonal geometry. Extensions of the geometry V are dealt with. First the structure is studied of the set of eigenvalues of an isometry of V. Next a study is made of the relations between two types of splitting fields of low dimensional orthogonal geometries. In the four dimensional case it is found that if the discriminant of V is a square, then splitting an isometry is equivalent to splitting two planes, and conversely. A helpful tool in the four dimensional case was a theorem proved using the techniques of Clifford algebras. Finally the study was related to certain maximal subfields of even Clifford algebras and closed with an example of a rotation which illustrates the limitations of the theory. Dissert. Abstr.

N69-23374 Montana State Univ., Missoula.
IDENTIFICATION OF DISTRIBUTED PARAMETER SYSTEMS USING FINITE DIFFERENCES
Paul Lee Collins, Jr. (Ph.D. Thesis) 1968 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-14357

A method is presented to identify the partial differential equations and associated boundary conditions of a distributed parameter system. Finite differences are used to approximate derivatives. Identification is carried out by using normal operating data. The accuracy of the identification depends only on approximation errors. Methods for decreasing these errors are presented. When the data is corrupted by noise additional errors are introduced and the unknown constants must be estimated. A performance index is presented which tends to minimize the combined effect of these two types of errors. The classical least squares estimator is developed to estimate linear and nonlinear systems. When the statistics of the measurement noise are available, a modified least squares estimator is presented which is applicable to linear systems. Examples and results of digital computer simulations are given. Dissert. Abstr.

N69-23375*# Stanford Univ., Calif. Dept. of Statistics.
A PROBLEM IN OPTIMAL SEARCH AND STOP
Sheldon M. Ross. 5 Sep. 1968 20 p refs Sponsored in part by NASA
(Contracts Nonr-225(53); DA-31-124-ARO-D-331)
(NASA-CR-100656; AD-675204; TR-113) Avail: CFSTI CSCL 12/2

An object is hidden in one of m (m < infinity) boxes and there is given prior probabilities p sub i superscript 0 that the object is in the ith box. A search of box i costs c sub i and finds the object with probability alpha sub i if the object is in the box. Suppose that a reward is earned if the object is found in the ith box. A strategy is any rule for determining when to search and if so which box. The major result is that an optimal strategy either searches a box with maximal value of (alpha sub i)p sub i/c sub i or else it never searches those boxes. Also, if rewards are equal, then an optimal strategy either searches a box with maximal (alpha sub i)p sub i/c sub i or else it stops. Author (TAB)

N69-23376*# Stanford Univ., Calif. Dept. of Statistics.
STATIC DECISION MODELS FOR QUEUEING SYSTEMS WITH NON-LINEAR WAITING COSTS
Shaler Stidham, Jr. 3 Sep. 1968 213 p refs Sponsored in part by NASA
(Contracts Nonr-225(53); Nonr-225(89))
(NASA-CR-100655; AD-674886; TR-112) Avail: CFSTI CSCL 12/2

Some models for the optimal design of queueing systems are presented. In most models studied, the decision variables are the number of servers (c) and the mean rate (mu) at which each serves. The objective function is the steady-state total expected cost rate of operating the system, which is assumed to be the sum of a cost of operating the service mechanism and a cost due to customers waiting in the system. It is shown that a single-server system is optimal for a wide class of arrival processes and service-time distributions, a wide variety of service and waiting cost functions, and a wide variety of system structures and operating policies. The optimality of the single-server system is first demonstrated for single-station models with general arrival process and degenerate, exponential, or Erlang service-time distribution, where the service-cost rate is proportional to both c and mu and the waiting-cost rate is proportional to the number of customers in the system. Several generalizations of this model are presented. Author (TAB)

N69-23382 State Univ. of Iowa, Iowa City.
DEFICIENCY AND STABILITY IN INFINITE DIMENSIONAL LINEAR TOPOLOGY
Douglas Warren Curtis (Ph.D. Thesis) 1968 32 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-14783

A closed subset A of a topological linear space has finite deficiency if for each positive integer n, there is a space homeomorphism taking A into a closed subspace with codimension n; A has topological infinite deficiency if there is a space homeomorphism taking it into a closed subspace with infinite codimension. Every infinite-dimensional locally convex Hausdorff linear space has closed infinite-dimensional subspaces with infinite codimension, and in such spaces topological infinite deficiency implies finite deficiency. Extending results of V. L. Klee, it is shown that closed σ-compact (compact) subsets of infinite-dimensional Banach (Fréchet) spaces have finite deficiency. This leads to the stable homogeneity of infinite-dimensional Banach (Fréchet) spaces with respect to closed finite-dimensional separable locally compact (compact) subsets, i.e., homeomorphisms between such subsets can be extended by stable space homeomorphisms. Dissert. Abstr.

N69-23383 Massachusetts Univ., Amherst.
ORTHOMODULAR SPACES
James Charles Decey, Jr. (Ph.D. Thesis) 1968 65 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-14584

An orthogonality space is a set together with a symmetric, irreflexive relation defined on it. Subsets of such spaces, any two distinct members which are related are called orthogonal sets. An internal condition is defined on such spaces which insures that they give rise to ortho-complete orthomodular partially ordered sets, represented as orderings of sets by inclusion. Such spaces are called orthomodular spaces. It is further shown that any ortho-complete orthomodular poset may be so represented. A general method of piecing together orthogonality spaces, the ortho-conditioned product, is defined. This product constitutes a generalization, simultaneously, of Cartesian product, horizontal sum, and operational product. It is shown that this product respects orthomodularity. Direct limits in the category of orthomodular posets and ortho-embeddings are shown, by construction, to exist. Dissert. Abstr.

N69-23389 Brigham Young Univ., Provo, Utah.
EVOLUTION OF PETROV TYPES OF SPACES IN GENERAL RELATIVITY
Lloyd Allen Case (Ph.D. Thesis) 1968 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-13711

A theoretical study is made of the evolution of one Petrov type of space-time into another ("evolution" meaning the change of the Petrov type a point observer would consider his local space-time). This study is motivated by a desire to increase the present understanding of this invariant classification and thereby improve its use as a tool for understanding solutions to the field equations of general relativity. The study happens to involve a detailed consideration of discontinuities in space-times. From this study an algorithm is developed that may be used to test the evolution of any closed form solution of interest. An example of its use is included. Also a flow diagram is found which indicates into which type any particular type may evolve and the necessary form of the discontinuity causing that change. Dissert. Abstr.

N69-23393 Syracuse Univ., N. Y.
APPLICATION OF HILBERT SPACE PRINCIPLES TO SOME BASIC PROBLEMS IN PROBABILITY AND COMMUNICATION THEORY
Nicholas Michael Guydosh (Ph.D. Thesis) 1968 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-13829

The dissertation puts in focus the geometrical model of a Hilbert space of random variables for a certain class of problems in communication theory and applied probability. A number of applications of this model are investigated. Among these are the regression problem from communication theory and the optimum system problem for random processes from communication theory. The solutions to these problems are interpreted in the context of the projection theorem of Hilbert space theory. The approaches of a number of authors are presented, analyzed, and modified. A seemingly novel method of interpreting the non-linear regression problem is proposed. An engineering oriented geometrical method for the optimum linear system is offered, the method is then extended to cover a certain class of nonlinear systems. Also this method, when applied to linear systems is used in conjunction with the Wiener-Lee synthesis. Dissert. Abstr.

N69-23394 California Univ., Berkeley.
THE PROBLEM OF INTEGRATION IN FINITE TERMS
Robert Henry Risch (Ph.D. Thesis) 1968 51 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-13950

An elementary function is a function of a real or complex variable which can be built up using such operation as sine, exponentiation, log, $\tan^{-1}$, and algebraic operations. The problem of integration in finite terms asks whether one can tell, for a given elementary function, f, whether or not $\int f$ is again an elementary function. If it is elementary, one should be able to find it in a systematic manner. The problem is formulated precisely; the underlying theory is discussed, and the problem is solved for those elementary functions in the subclass built up without using irrational algebraic operations. Dissert. Abstr.

N69-23395 Utah Univ., Salt Lake City.
ABSOLUTE CONTINUITY AND THE RADON THEOREM
Stanley Glen Wayment (Ph.D. Thesis) 1968 46 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-14435

Let C be the set of all continuous functions f from a compact Hausdorff space H into a Banach space X. Let T be a continuous linear transformation from C into a Banach space Y. Recent works show that a Riesz representation theorem holds in this setting where integration is with respect to a finitely additive operator-valued measure function K defined on a ring of sets in H which contain the closed G_δ's. Relative to such a measure one can define a Lebesgue-type integral. Such an integral defines from a measure K a new measure G. A definition of absolute continuity is given, and it is shown that such a G is absolutely continuous with respect to K. The concept of an integrable function is replaced by the notion of an integrable sequence of simple functions on a set E in the ring. Such a sequence is said to be a slur, and if B(E) is a slur for each E in the ring, then B is said to be a blur. If G is absolutely continuous with respect to K, then there exists a blur B so that the integral over E with respect to K gives G(E). Dissert. Abstr.

N69-23396 North Carolina State Univ., Raleigh.
THE DISTRIBUTIONAL FINITE FOURIER TRANSFORM
Grover Karl Warmbrod (Ph.D. Thesis) 1968 62 p
Avail: Univ. Microfilms: HC $3.60/Mjcrofilm $3.00 Order No. 68-14679

A new approach to the finite Fourier transform of distributions is developed. This generalizes to distributions the idea of truncating a function to an interval I and then defining a Fourier series expansion which periodically extends the function. It is shown that the finite Fourier transform of any distribution may be represented as a regular functional which is generated by a continuous function of slow growth. This representation then enables us to define a convergent Fourier series for any distribution f that will be equivalent to f on I. It is also shown that for any distribution f the inverse Fourier transforms is the limit of the Fourier series expansion of f as the period (length of I) tends to infinity. Dissert. Abstr.

N69-23413 Rutgers Univ., New Brunswick, N. J.
THE ALGEBRA AND GEOMETRY OF POLYADIC QUASIGROUPS AND LOOPS
Richard George Bauer (Ph.D. Thesis) 1968 221 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 68-14238

For an integer $n \geq 2$, an n-adic operation o on G is a collection of ordered (n+1)-tuples of elements of G such that for every $x_1,\ldots,x_n \in G$, there is a unique $y \in G$ for which $(x_1,\ldots,x_n,y) \in o$ and y is designated $o(x_1,\ldots,x_n)$. (G,o) is an n-groupoid. Polyadic generalizations of quasigroups, loops, and groups are defined. Properties inherited by homomorphs and n-subgroups are investigated. Dissert. Abstr.

N69-23427# Queens Univ., Kingston (Ontario). Dept. of Mathematics.
THE EFFECT OF HARD LIMITING ON SIGNAL TO INTERFERENCE RATIOS
Robert G. Lyons Feb 1969 78 p refs
(Contract CD-DRB-713014)
(RR-69-1) Avail: CFSTI

The problem considered in this paper is as follows: given several constant amplitude signals plus gaussian noise, what is the power of that component of the repeater output having the characteristics of one desired signal? Signals applied to the repeater are assumed to be angle modulated sinusoids satisfying the condition that, over a sufficient period, relative phase angles between signals pass through all angles in $[0,2\pi]$. This leads to the assumption that at any time t, the phase difference between any two signals can be considered to be a random variable uniformly distributed on $[0,2\pi]$. Author

N69-23459 State Univ. of Iowa, Iowa City.
ON THE ZEROS OF SOLUTIONS OF ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS
Paul Albert Haeder (Ph.D. Thesis) 1968 39 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-14794

Theorems are developed for locating regions where the zeros of elliptic partial differential equations can be found. Both the second-order self-adjoint elliptic partial differential equation and the second-order general elliptic partial differential equation are considered. In each case the region studied is an n-dimensional cube in Euclidean n-space. Applications of the theorems to equations for which there are known solutions display results comparable to those known to be true for such solutions. Dissert. Abstr.

N69-23460 Colorado Univ., Boulder.
MATRICES OVER DIVISION RINGS AND EPR MATRICES
John Walter Duke (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-14376

The emphasis is upon square matrices A over a division ring D with center C. An element d in D is called an eigenvalue of A if there exists a nonzero vector v for which $Av = vd$. EP linear transformations and matrices over a field F with an involutory automorphism are examined. In addition, certain nilpotent EP matrices all of whose powers are EP are studied. Dissert. Abstr.

N69-23484 Utah Univ., Salt Lake City.
ONE-TO-ONE CONTINUOUS MAPPINGS INTO THE PLANE
Dix Hayes Pettey (Ph.D. Thesis) 1968 31 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-14422

A theorem is proven that is strong enough to show that in the 2-dimensional case there is no counterexample of the same type as those found earlier for higher dimensions. It is proven that if M^1 is a separable 1-manifold and f is a 1-1continuous mapping of M^1 into E^2 such that $f(M^1)$ is closed in E^2, then $f(M^1$

separates E^2. Using the above result, it is shown that if M^2 is a connected 2-manifold with boundary and f is a 1-1 continuous mapping of M^2 onto E^2 or S^2, then f is a homeomorphism. It is proven that if each of M^2 and Y^2 is a connected 2-manifold with boundary, Int Y^2 is an open 2-cell, and f is a 1-1 continuous mapping of M^2 onto Y^2, then f is a homeomorphism. An immediate corollary of this last result is that a connected 2-manifold with boundary can be mapped 1-1 and continuously onto a 2-cell only by a homeomorphism. Dissert Abstr.

N69-23478 Pittsburgh Univ., Pa.
RELATIONS BETWEEN ORDER NUMBERS, TRANSFORMATIONS, AND LYAPUNOV FUNCTIONS
William Lloyd Montgomery (Ph.D. Thesis) 1968 240 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 68-14178

The relationships between properties of order numbers and types of Lyapunov stability have, to this author's knowledge, never been adequately delineated. Furthermore, fundamental relations between order numbers, Lyapunov functions, and linear transformations have not been revealed in the literature. A major objective of this dissertation is to investigate those fundamental relations, as well as those which exist between properties of order numbers and types of stability behavior. Another major objective is to determine the properties a linear transformation should possess to insure that stability behavior, or uniform stability behavior is preserved as one system is transformed into another. The approach to these objectives begins by considering two concepts that are vital to later studies. The first involves a Lyapunov function which varies with the starting time, t_o, and the second involves the properties of eigenvalues of time-varying matrices. Dissert. Abstr.

N69-23484 Denver Univ., Colo.
SHORT TIME STABILITY OF FORCED LINEAR TIME-VARYING SYSTEMS
John P. Portasik (Ph.D. Thesis) 1968 63 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-13709

Short-time stability deals with systems operating between specified bounds over a finite time interval. Examples of the application of this concept of stability are found in missile and satellite systems where operating times are often of finite duration, or during the penetration of a re-entry vehicle where instability of flight could occur prior to impact. This thesis investigates the short-time stability of linear time-varying systems. Sufficient conditions for short-time stability are developed in terms of the coefficient matrix, the forcing function, and the initial state. The results are applied to several examples of linear time-varying and time-invariant systems. Dissert. Abstr.

N69-23515 Dartmouth Coll., Hanover, N. H.
ISOTOPIC UNKNOTTING IN $M^2 \times I$
Charles Dana Feustel (Ph.D. Thesis) 1968 68 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-14905

Brown's results on unknotting in $M^2 \times I$ are generalized. Let M be a compact 2-manifold. Let I be the unit interval. All spaces are assumed to be simplicial complexes, and all maps are p. l. It is shown that any homeomorphism from $M \times I$ to itself leaving the union of $bd(M) \times I$ and $M \times |o|$ fixed is isotopic to the identity leaving the above portion of $bd(M \times I)$ fixed. Necessary and sufficient conditions are given for the existence of isotopies leaving all of $bd(M \times I)$ fixed, in most cases when Brown's theorems guarantee the existence of a homeomorphism leaving the union of $bd(M) \times I$ and $M \times |o|$ fixed. Dissert. Abstr.

N69-23547 St. Louis Univ., Mo.
HOMOGENEOUS IDENTITIES ON ALGEBRAIC LOOPS
Carlos Eduardo Vasco (Ph.D. Thesis) 1968 169 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-14084

The design is studied of a convenient formal machinery for the abstract treatment of homogeneous identities on algebraic systems with a non-associative binary operation, of which loops are a particular case. Formal tools are applied to obtain general results on homogeneous identities. The theory of the perimeter cancellation of the third- and fourth-degree identities is applied in order to obtain a complete list of those identities and to study the mutual implications among them. All non-permutational third- and fourth-degree identities over the 109 nonisomorphic loops of order 6 are investigated. Dissert. Abstr.

N69-23560 California Univ., Berkeley.
DIFFERENTIABLE LINKS IN MANIFOLDS
Robert Louis Chazin (Ph.D. Thesis) 1968 36 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-13892

The isotopy classification of links in M is studied. A classification of links in M^m in terms of an exact sequence is obtained, one of whose terms is the group of framed links in S^m. A similar classification for framed links whose components are spheres carrying a normal frame is also obtained. The relevant definitions and the classification theorems are given along with proofs of the theorems. The problem of classifying secondary handlebodies with a second set of handles attached is studied. Dissert. Abstr.

N69-23562 St. Louis Univ., Mo.
2 BANACH SPACES
Albert George White, Jr. (Ph.D. Thesis) 1968 43 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-14089

Since normed linear spaces and Banach spaces are a very fruitful area of mathematics, it is quite natural to extend these 2-normed spaces to 2-Banach spaces. In this dissertation Cauchy sequence, convergent sequence, and 2-Banach space are defined. Definitions of 2-functional, bounded 2-functional, norm of a bounded 2-functional, and continuous 2-functional are also included. Dissert. Abstr.

N69-23596 Duke Univ., Durham, N. C.
THE STATISTICAL ANALYSIS OF GENERALIZED SPECTRAL ESTIMATORS
David Frank Palmer (Ph.D. Thesis) 1968 137 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-14319

The various methods of power density spectrum estimation based on a finite data interval are briefly reviewed. Patterns observed in the known techniques are consolidated into forms modeled upon the defining equations for power density spectra. Two generalized estimators result, one which usually would be implemented with a digital computer, the other with physical filters. Identical forms of bias and variance equations are derived for the two generalized estimators; differences of individual techniques are completely contained in shaping functions within the general equations. An interpretation of the effects of the shaping functions is given, thereby providing a unified analysis of the generalized estimators. A collection of bias shaping functions for computer type estimators, often termed window functions in the literature, is presented along with functions for networks consisting of Butterworth filters followed by square-law devices and integrators. Dissert. Abstr.

N69-23602 California Univ., Los Angeles.
DIFFERENTIAL INEQUALITIES IN HILBERT SPACE
Angus Percy Andrews 1968 196 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-14541

For a function defined on a real interval with values in a Hilbert space and of the Sobolev class, the norm-composition is "essentially" absolutely continuous. Consequently, "generalized convexity" results can be obtained for *weak* solutions of differential inequalities in Hilbert space. Using the generalized convexity inequality, one can obtain lower bounds, asymptotic lower bounds and "backward uniqueness" for weak solutions of differential inequalities in Hilbert space. The results can be applied to abstract parabolic equations and to the study of the local behavior of solutions of elliptic partial differential equations. For abstract parabolic equations, one obtains a generalized convexity condition. Dissert. Abstr.

N69-23603 State Univ. of Iowa, Iowa City.
CELLS AND CELLULARITY IN INFINITE-DIMENSIONAL NORMED LINEAR SPACES
Robert Allan McCoy (Ph.D. Thesis) 1968 47 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-14806

There are certain topological properties in Euclidean n-space which can be conveniently studied as properties in normed linear spaces. In this dissertation concepts such as open and closed cells, cellular sets, point-like sets, and decomposition spaces are studied and related in normed linear spaces. Let E be a normed linear space and for any positive real number r let $B_r = \{x \in E: \|x\| \leq r\}$. An *open cell in E* is an open subset of E which is homeomorphic to E.
Dissert. Abstr.

N69-23604 California Univ., Los Angeles.
QUADRATIC OPTIMAL CONTROL PROBLEMS
Edward Yoshio Mikami (Ph.D. Thesis) 1968 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-14548

A quadratic form is studied on the space of arcs. Hilbert space theory is used to obtain the Euler-Lagrange equations for this problem. The quadratic form J(x) is then assumed to satisfy the strengthened Clebsch condition and J(x) is shown to be an elliptic form. A theory of focal points is developed and it is shown that the signature of J(x) is equal to the sum of the focal points on the open interval. The focal points correspond to certain subintervals on which a focal arc is zero. Focal arcs satisfy the Euler-Lagrange equations and the fact that they may be zero on subintervals is attributed to the abnormality of the problem.
Dissert. Abstr.

N69-23634 Utah Univ., Salt Lake City.
MODIFIED KALMAN FILTERING FOR A CLASS OF NONLINEAR SYSTEMS
Kermit William Reister (Ph.D. Thesis) 1968 120 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-14041

The extension of Kalman type state vector estimation to a class of nonlinear systems is developed. This extension is called a modified Kalman filter. A review of linear systems is presented for reference purposes, since the modified Kalman filter makes extensive use of the linear system analysis for recognition purposes. The modified filter relates a nonlinear system to a collection of artificial time independent linear systems. The nonlinear estimation method is based on a Taylor expansion of the system functions with the retention of the remainder terms in the estimated state vector expression. The class of nonlinear functions for which the modified filter is applicable is defined. A computer program to simulate the method is presented. Examples are given demonstrating the modified Kalman filter. Dissert. Abstr.

N69-23635 New Mexico State Univ., Las Cruces.
ARTINIAN ALMOST ABELIAN GROUPS AND THEIR GROUPS OF AUTOMORPHISMS
Annemarie Schlette (Ph.D. Thesis) 1968 54 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-13553

An artinian and almost abelian group is an extension of an abelian group with minimum condition for subgroups by a finite group. The fact that a group G is artinian and almost abelian is equivalent to either of the following conditions: (1) G is a torsion group, and its torsion group of automorphisms is artinian and almost abelian. (2) G is a torsion group with artinian and almost abelian central quotient group, and primary elementary abelian groups of automorphisms of G are countable. A group G has artinian and almost abelian central quotient group if, and only if, it is almost abelian and has artinian commutator subgroup G'. Applications of these results show that a group G is artinian with finite central quotient group if, and only if, it is a torsion group, whose torsion group of automorphisms is finite; and that the group G is finite if, and only if, it is a torsion group with finite automorphism group.
Dissert. Abstr.

N69-23640*# Auburn Univ., Ala. Engineering Experiment Station.
QUANTIZATION ERROR-BOUNDS FOR HYBRID CONTROL SYSTEMS Technical Report, 28 May–28 Sep. 1968
C. L. Phillips 28 Sep. 1968 110 p refs
(Contract NAS8-11274)
NASA-CR-100869; TR-13) Avail: CFSTI CSCL 12A

The concept of uniform boundedness of solutions, which arises in connection with Liapunov stability theory, is extended to discrete time systems. This is accomplished by establishing the properties of a positive definite function and its first forward difference which are requisite to the definition of two sets M and M_r, in the state space, such that, if the system state enters M, it cannot leave M_r. The boundedness of motions idea is used to compute a system error-bound for each quantizer acting singly. A composite error bound is computed by combining these bounds. It is further established that an error-bound may be computed from the boundedness of motions theory by determining simultaneously the contributions of all quantizers. The problem of establishing a least upper-bound on quantization error is formulated as a discrete time, optimal control theory problem. A closed form solution is given for the least upper-bound on quantization error at any sampling instant NT by the application of the discrete maximum principle.
Author

N69-23644 California Univ., Los Angeles.
VECTOR VALUED ORLICZ SPACES
Michael Samuel Skaff (Ph.D. Thesis) 1968 190 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-14554

Properties of linear spaces generated by GN-functions, which are called vector valued Orlicz spaces, are studied. This work extends the usual theory of Orlicz spaces generated by real valued N-functions of a real variable. An integral representation theorem is given for convex functions of several variables defined on a class of measurable, absolutely continuous, vector valued functions. Also, the gradient mapping for convex functions of several variables is

defined, and results are given determining when such mappings are one-to-one and onto. The properties of GN-functions are examined, and a generalized delta or growth condition is introduced. The concept of an integral mean for GN-functions is developed. Finally, the concept of the conjugate GN-function is established, and it is determined when this function is a GN-function. Also, conditions are given when a GN-function can be defined by the conjugate function. Dissert. Abstr.

N69-23657 St. Louis Univ., Mo.
FIFTH ORDER PSEUDO-RUNGE-KUTTA METHODS
William Bromley Gruttke (Ph.D. Thesis) 1968 137 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-14067

Fifth order pseudo Runge–Kutta methods are derived for the numerical approximation of the solution of systems of ordinary differential equations. The development of pseudo Runge–Kutta methods is accomplished by essentially applying Runge–Kutta methods at two initial points and combining the methods. It is seen that pseudo Runge–Kutta methods are not one step methods, nor are they linear multistep methods. They do, however, have characteristics of both Runge–Kutta type methods and linear multistep methods. Like Runge–Kutta type methods, they are derived with a variable stepsize and can change stepsize easily. Like linear multistep methods, they require starter methods to provide initial values. An important feature of the fifth order pseudo Runge–Kutta methods is that, for a fixed stepsize, they require two less evaluations of the given function than does the classical Runge–Kutta–Nyström method. This means a significant savings of computer time for initial value problems involving complicated functions. Dissert. Abstr.

N69-23687 California Univ., Berkeley.
MODAL SUBSPACES IN COMPLEX DOMAIN
Bushan Lall Dhoopar (Ph.D. Thesis) 1968 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-13898

Two coupled nonlinear autonomous second order differential equations are considered. The two equations are called homogeneous and nonhomogeneous. Both the equations are expressed as $\dot{X} = F(X)$ where X is a vector in an N-dimensional space over the field of complex numbers and F is a vector valued function. The simplest kind of invariant substance of the N-dimensional space is found and is called the modal subspace. The modal subspace is equivalently considered a two dimensional real subspace T. On T, the modal subspace, one dimensional invariant subspaces are found, and their properties discussed. The possible two dimensional periodic solutions on T are discussed with emphasis on the symmetric arc solutions. The characteristics of these periodic modal solutions, found by analytical approach, are verified by digital and analog computations. Dissert. Abstr.

N69-23694 Arizona State Univ., Tempe.
QUASI-DEVELOPABLE SPACES
Harold R. Bennett (Ph.D. Thesis) 1968 53 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-14985

Various conditions are given which insure that a quasi-developable space is a Moore space or even metrizable. A regular quasi-developable is a Moore space if and only if closed sets are G_δ sets. It is also shown that a bicompact, quasi-developable Hausdorff space is metrizable. This hypothesis is factored into standard intermediate steps. It is shown that pointwise paracompactness and some form of completeness on the space is all that is needed for a quasi-developable space to be metrizable. Examples are given to show how far removed a quasi-developable space is from a Moore space. Linearly ordered quasi-developable spaces are shown to have a point countable basis, and linearly ordered spaces with a point countable basis are shown to be paracompact. Dissert. Abstr.

N69-23721 Missouri Univ., Rolla.
INFERENCES ON THE PARAMETERS OF THE WEIBULL DISTRIBUTION
Darrel Ray Thoman (Ph.D. Thesis) 1968 97 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-14692

The small and moderate sample size properties of the maximum likelihood estimators were studied and their superiority established. The problem of making further inferences which are based on the maximum likelihood estimates of the parameters was then considered. The inferences that are presented can be divided into those based on a single sample and those based on two independent samples from Weibull distributions and include solutions to the standard problems of interval estimation and hypothesis testing. In addition, tolerance limits and confidence limits on the reliability are given. These procedures were accomplished by the discovery of certain pivotal functions whose distributions can be obtained by Monte Carlo methods. Although the distributions are only tabulated for complete samples, the procedures can be extended to the case of censored sampling, since for this type of sampling the basic functions remain pivotal. Dissert. Abstr.

N69-23734 Yale Univ., New Haven, Conn.
FORMAL SYSTEMS AND SYNTACTICAL ANALYSIS
Ziad Jamil Ghandour (Ph.D. Thesis) 1968 159 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-14844

Formal systems in general and canonic systems in particular are analyzed. The main objective is to construct a process that can test the membership of a string to recursively defined sets. If the test is successful, the process gives the structure of the string. Computer languages, mathematical theories and, by Church thesis, any effective process can be defined recursively. Canonic systems, which are applied variants of Post's canonical systems and Smullyan's elementary formal systems, are used to define sets recursively. Canonic systems are generator-oriented; they specify the rules, which we call canons, for the recursive generation of strings. In their general form, canonic systems are capable of describing recursively enumerable sets. Restrictions on the canonic systems are introduced and obtained a hierarchy of classes of canonic systems. Dissert Abstr.

N69-23748*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ESTIMATION OF BIT PROBABILITY OF ERROR USING SYNC WORD ERROR RATE DATA
Charles A. Rohde Apr. 1969 17 p ref Submitted for publication (NASA-TM-X-63528; X-560-69-151) Avail: CFSTI CSCL 12A

Assuming bit errors are independently distributed with a constant probability of error, p_e, it is shown that a simple estimator is highly efficient for estimation of p_e. The estimator is based on a simple function of the number of sync words containing no bit errors. The estimator is shown to be maximum likelihood, minimum chi-square and modified minimum chi-square when the quality index reported is simply the percent of frames containing zero errors. An approximate confidence interval for p_e is obtained and a determination of the number of sync words to observe in order to obtain an approximate confidence interval of fixed length is indicated. The method of scoring which can be used to obtain a more efficient estimator of p_e is described. Author

N69-23750 St. Louis Univ., Mo.
AN OPTIMIZING DISTRIBUTION FUNCTION UTILIZING QUEUEING THEORY TO DETERMINE THE RELIABILITY OF A SYSTEM
Gerald Paul Harshany (Ph.D. Thesis) 1968 75 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-14069

A waiting line or queue is characterized by arrivals and a service channel into which the arrivals enter. This waiting line was used to formulate a random walk model which simulates arrivals in the queue, or, equivalently, the failures of an operating system. A general polynomial cumulative hazard rate was used for the service channel distribution and, in particular, an application was made with a polynomial of degree one. The arrival distribution used is an hyper-exponential which has the exponential as a special case. The Laplace transform of the service distribution was obtained and used in the Laplace transform of the waiting time distribution. From the power series expansion of this latter transform, the mean waiting time was obtained and used as the size of the step for the particle in the random walk model. The mean service time was used for the duration of the step. An application for a particular set of values for the various parameters was made to test the suitability of the model, and the various ranges of existence for the mean waiting time are indicated. Several different possible tests of hypotheses are suggested based on the range of existence for the mean waiting time. Dissert. Abstr.

N69-23788*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE USE OF INTEGRAL TRANSFORMS IN THE ESTIMATION OF TIME VARIABLE PARAMETERS
Henry C. Lessing and D. Francis Crane Washington May 1969 47 p refs
(NASA-TN-D-5194) Avail: CFSTI CSCL 12A

A study was made of the concept of integral transformations applied to the differential form of the system equations and the use of these equations in parameter estimation. The two principal results of the study are given: the extension of the transformation equations to explicitly account for time variability of the system parameters, and an extension of the application of the concept to the output error formulation of the parameter estimation problem. It is shown that, as a result, the output error formulation acquires stability properties that were impossible previously. Experimental results are presented to illustrate the theoretical developments. These results show the ability of the new formulations to estimate parameters that are highly variable with time. Author

N69-23875# Laboratoire d'Automatique et de ses Application Spatiales, Toulouse (France).
SENSITIVITY PROBLEMS LINKED TO CERTAIN FORKS IN NONLINEAR RECURSIVE EQUATIONS [PROBLEMES DE SENSIBILITE LIES A CERTAINES BIFURCATIONS DANS LES RECURRENCES NON LINEAIRES]
I. Gumowski and C. Mira 1968 14 p refs In FRENCH
Presented at the 2nd IFAC Symp. on System Sensitivity and Adaptive Control, Dubrovnik, Jugoslavia, 26–31 Aug. 1968
(LAAS-523) Avail: CFSTI

Certain qualitative aspects of the sensitivity to small variations of the parameters in a system defined by a recursive equation are analyzed. Consideration is given to certain forks in a two dimensional space, not caused by critical points, which are linked with an important deformation of the stability boundary at a double point and an example is given of the 'structural' sensitivity when the function is approached by a 'piecewise' linear function. ESRO

N69-23929*# Rice Univ., Houston, Texas.
DEPT. OF MECHANICAL AND AEROSPACE ENGINEERING AND MATERIALS SCIENCE. THE RESTORATION OF CONSTRAINTS IN NONHOLONOMIC PROBLEMS
Angelo Miele and John N. Damoulakis 1968 24 p refs
(Grant NGR-44-006-089)
(NASA-CR-100731; AAR-40) Avail: CFSTI CSCL 12A

A system described by n differential equations of the first order involving n state variables and m control variables is described. It is assumed that a nominal state and a nominal control, not satisfying all the equations, but consistent with the boundary conditions, are given. An iterative procedure is developed leading to a varied state and a varied control consistent with all the equations and the boundary conditions. The procedure involves quasilinearization with an added optimality condition, namely, the requirement of least-square change of the control. Several numerical examples are included. Author

N69-24041# California Univ., Berkeley.
THE CONSISTENCY OF NONLINEAR REGRESSIONS
Edmond Malinvaud Oct. 1968 28 p
(Contract Nonr-222(77))
(AD-680032; TR-29) Avail: CFSTI CSCL 12/1

This paper gives alternative sufficient conditions for the least squares estimates to be consistent in the case of nonlinear regression, i.e., without the assumption of linearity of g with respect to the parameters. TAB

N69-24126# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
SOME MATHEMATICAL PROPERTIES OF THE FINITE-DIFFERENCE REPRESENTATION OF THE MULTIGROUP KINETICS EQUATIONS
Weston M. Stacey, Jr. Jul. 1968 12 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-7030(WMS-8)) Avail: CFSTI

The matrix of coefficients which arises in the multigroup finite-difference representation of the reactor kinetics equations is shown to be real, essentially non-negative, and under certain conditions, irreducible. Such a matrix has a unique positive eigenvector with a real simple eigenvalue greater than the real part of any other eigenvalue of the matrix. The values of the delayed neutron decay constant are shown to be excluded from the eigenvalue spectrum of this matrix. For the case of one energy group, the matrix can be shown to be a kinetics matrix, the extensive properties of which have previously been worked out. Author (NSA)

N69-24129# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
RECAP-D: A DEPLETION AND EDIT CODE FOR RECAP-4C MONTE CARLO CALCULATIONS
Ernest R. Venerus Jul. 1968 17 p refs
(Contract W-31-109-eng-52)
(KAPL-M-6940 (ERV-2)) Avail: CFSTI

RECAP-D is a depletion code which has been automated to read a tape generated by a RECAP-4C Monte Carlo calculation, edit absorption rates and deplete various isotopes based on an input chain description. Depleted number densities are provided in the form of punched card output which can be used directly in the Monte Carlo calculation of the next depletion step. (In Fortran IV) Author (NSA)

N69-24138# National Physical Lab., Teddington (England). Ship Div.
MEASUREMENTS OF THE WAVE RESISTANCE OF A SERIES OF MATHEMATICAL MODELS, INCLUDING COMPARISON WITH THEORETICAL ESTIMATES
J. T. Everest Jan. 1969 32 p refs
(NPL-Ship-120) Avail: CFSTI

Measurements of the wave pattern resistance of three simple mathematical forms have been made for Froude numbers in the range 0.2–0.6 Length/draft ratio was held constant at 16, but length/beam ratio was varied between 5 and 20. The results have been compared with theoretical estimates obtained by Wigley, and for the finer forms at Froude numbers in excess of 0.35, agreement was good. Comparison of Wigley's results with those obtained using an approximate but more versatile computer method has also been completed. An analysis of both theoretical and experimental wave resistances into angular components has been achieved; agreement was found to be good throughout the range of Froude numbers considered. Comparison of measured wave elevations around the hulls with theoretical predictions gave poor correlation. A simple attempt to assess the magnitude of viscous pressure resistance demonstrated the rapid rise of this term as length/beam ratio was reduced to a value of five. Author (ESRO)

N69-24180*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPTIMAL NONLINEAR ESTIMATION BASED ON ORTHOGONAL EXPANSIONS
William Kizner 15 Apr. 1969 18 p refs
(Contract NAS7-100)
(NASA-CR-100759; JPL-TR-32-1366) Copyright. Avail: CFSTI CSCL 12A

If a quadratic loss function is used, then the conditional mean of *x* given the observations and *a priori* information is used. The conditional mean is calculated using an *n* dimensional Gram–Charlier expansion of the *a posteriori* probability density function. A numerical method for finding this distribution is given, and some of its properties are discussed, including the case for which the method is optimal. If a more general kind of loss function is used and a mean-square approximation to the *a posteriori* probability density function is desired, a Hermite function expansion which converges in the mean square is employed. Again, numerical methods are given for finding the coefficients of the expansion, and the optimality of this procedure is discussed. Author

N69-24213# Texas A&M Univ., College Station. Inst. of Statistics.
SPHERICAL PROGRAMMING: A CONVEX PROGRAMMING ALGORITHM
S. W. McGuire, R. R. Hocking, and H. O. Hartley Oct. 1968 26 p refs
(Contract N00014-68-A-0140)
(AD-680463; Themis-TR-5) Avail: CFSTI CSCL 12/2

A new algorithm is developed for solving the problem of maximizing a function, f(x), of n variables subject to m linear inequality constraints. The procedure consists of solving a sequence of subproblems which require the maximization of f(x) over a hypersphere. A simple algorithm is developed for solving the subproblems. The sequence of subproblem optima is shown to converge to the constrained optimum of f(x) if f(x) is concave. A discussion is given of our limited computational experience with the algorithm. Author (TAB)

N69-24228# Institut fur Plasmaphysik G.M.B.H., Garching (West Germany).
ON THE NUMERICAL TREATMENT OF HYPERBOLIC DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS, PARTICULARLY THE n-DIMENSIONAL WAVE EQUATION [UEBER DIE NUMERISCHE BEHANDLUNG HYPERBOLISCHER DIFFERENTIALGLEICHUNGEN MIT KONSTANTEN KOEFFIZIENTEN, INSBESONDERE DER n-DIMENSIONALEN WELLENGLEICHUNG]
Karl Graf Finck von Finckenstein Dec. 1968 36 p refs In GERMAN; ENGLISH Summary
(IPP-6/73) Avail: CFSTI

Second-order difference schemes for numerically solving linear hyperbolic differential equations with constant coefficients were investiged. Let h be the time step size, $\mu_i h$, $i = 1, \ldots, n$ the space step sizes of the lattice network. The stability criterion is then: $\mu_i \geq \| Ai \| \cdot n\sqrt{n}$, $i = 1, \ldots, n$ where the Ai are the coefficients of the differential equation and $\| Ai \|$ the spectral norm of Ai. Lax and Wendroff prove this inequality for $n = 2$, but it can easily be generalized. The above criterion is improved for a wave equation. Author

N69-24303# California Univ., Los Angeles. Western Management Science Institute.
THE ECONOMIC MAN'S LOGIC
Jacob Marschak Dec. 1968 34 p refs Sponsored in part by ONR and NSF *Its* Working Paper No. 145
(AD-682918) Avail: CFSTI CSCL 5/3

The (purely mathematical) law of large numbers follows from the definition of a probability measure, combined with the assumption that each of an indefinitely long sequence of trials has the same probability distribution of outcomes. Such trials are called repeated and independent. Moreover, if the binary preference relation completely orders the set of decisions and obeys a few other axioms, the (consistent) decision maker will be indifferent between betting on a specified outcome of any one of such trials, and on any event whose probability is equal to the relative frequency of such outcomes in a large number of observed trials. In his Foundations of Inductive Logic, Sir Roy Harrod declares, on the other hand, that our experience justifies the assumption that a physical phenomenon always observed in the past will be frequently observed in the future. In the present paper, a contribution to a Volume in Honor of Harrod, the possible relation is discussed between this continuity principle of his and the properties of those sequences of physical events which the consistent decision-maker might regard as being, approximately, repeated and independent. Author (TAB)

N69-24306# Minnesota Univ., Minneapolis. Dept. of Statistics.
PROBABILITY AND STATISTICS Final Report
G. Kallianpur 18 Dec. 1968 7 p refs
(Grant AF-AFOSR-885-65)
(AD-680051; AFOSR-68-2815) Avail: CFSTI CSCL 12/1

Research on the derivation of stochastic differential equations in estimation and filtering problems in stochastic processes was completed. The system processes are continuous Markov processes with special emphasis on those which are solutions of a diffusion equation. The stochastic equation for the optimal filter is given not only in the form of an Ito differential equation but alternatively, as a differential equation of the Fisk-Stratonovich type. Other areas of research investigated under this grant are asymptotic properties of Bayes estimates for estimation problems with Markov process observations, distribution theory, ranking problems, prediction theory, stationary spectral measure and quasi-variant measures. References to papers completed in the above areas are included. Author (TAB)

N69-24367# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FORMULAS FOR CALCULATING BESSEL FUNCTIONS OF INTEGRAL ORDER AND COMPLEX ARGUMENT
Alexander S. Elder Nov. 1968 29 p refs
(AD-680209; BRL-1423) Avail: CFSTI CSCL 12/1

Formulas for calculating Bessel functions of integral order and complex argument are derived in this report. Calculations based on these formulas are not subject to the loss of significant figures which occurs in the Taylor and Neumann series when the argument is large and the order is small. Author (TAB)

N69-24374# System Development Corp., Santa Monica, Calif.
EXACT BAYESIAN TESTS OF SHARP HYPOTHESES
James M. Dickey, B. P. Lientz, and V. K. Marthy Oct. 1968 24 p refs
(AD-680109; SDC-SP-3236) Avail: Issuing Activity CSCL 12/1

The Bayesian theory for testing a hypothesis defined by fixed values of parameters is presented in general terms without approximations. Arbitrary positive prior probability is attached to the hypothesis. The conditional distribution of the nuisance parameters given the parameters defining the hypothesis is assumed to be continuous in the latter at their values for the hypothesis. Families of integrable conjugate prior distributions are assigned under the alternative hypothesis for the problem of equality of Bernoulli parameters, for multivariate extensions, and for multivariate normal problems. Author (TAB)

N69-24391# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
SAMPLE-LIKE DISTRIBUTION OF AN ORDER STATISTIC UNDER GENERAL NONSAMPLE CONDITIONS AND SOME ASYMPTOTIC IMPLICATIONS
John E. Walsh 7 Oct. 1968 10 p refs
(Contract N00014-68-A-0515)
(AD-680440; TR-18) Avail: CFSTI CSCL 12/1

Consider n univariate observations having an arbitrary joint distribution. In general, the distribution of any order statistic of these observations is shown to be the same as that of this order statistic for a random sample of size n (from a distribution determined by the joint distribution). Thus, individual order statistics can be considered to arise from samples. However, the distribution sampled can change greatly with the order statistic. These results are useful in determining asymptotic distributional properties of extremes and percentage points of the observations. That is, for given large n, an asymptotic distribution developed assuming a sample is usable for the more general situation if the distribution sampled has a suitable form. Thus, for the continuous case, observed percentage points have asymptotically normal distributions under very general conditions. Also, asymptotic distributions developed for extremes of samples should often be usable for continuous situations. Applications of these asymptotic results for prediction are discussed for situations where several sets of observations (same n for each set) are independently obtained from approximately the same source. Author (TAB)

N69-24396# Technische Hochschule Munchen (West Germany).
A METHOD FOR THE NUMERICAL SOLUTION OF NONLINEAR FREDHOLM EQUATIONS [EINE METHODE ZUR NUMERISCHEN LOESUNG VON NICHTLINEAREN GLEICHUNGEN FREDHOLMSCHER ART]
Hansjoerg Wacker (Ph.D. Thesis) 1968 97 p refs In GERMAN
Avail: CFSTI

This method concerns the numerical solution of problems of the following type: (1) nonlinear integro-differential equations; (2) systems of nonlinear integro-differential equations; (3) integro-differential equations of a higher order; (4) nonlinear integral equations; and (5) systems of nonlinear integral equations. The method results in approximate solutions for general nonlinear cases; an integral or integro-differential equation is solved at each step for which an approximation is available. Conditions for the uniqueness of the solutions are derived and error estimates are given. Transl. by K.W.

N69-24425# RAND Corp., Santa Monica, Calif.
SOME CURVE-FITTING FUNDAMENTALS
R. L. Petruschell Dec. 1968 138 p refs
(Contract DAHC15-67-C-0150)
(AD-680613; RM-5766-SA) Avail: CFSTI CSCL 14/1

A description is given of the curve-fitting process for the cost analyst. The study is characterized by intuitive discussions with illustrations of computational procedures, and treats the more complex relationships of cost analysis by an approach that integrates analytic geometry with curve-fitting methods. In order to develop an equation to describe a particular relationship, the approach combines the properties of specific functional forms--the straight line, the exponential, the power function, and the parabola--with the values of equation constants. Examples of curves fit to two-variable and multi-variable relationships are shown. Both linear and nonlinear cases are included. Author (TAB)

N69-24435# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
ON THE DISTRIBUTIONS OF THE QUASI-RANGE AND MIDRANGE FOR SAMPLES FROM A NORMAL POPULATION
G. M. Jones, C. Kapadia, D. B. Owen, and R. P. Bland Oct. 1968 11 p refs
(Contract N00014-68-A-0515)
(AD-680262; TR-20) Avail: CFSTI CSCL 12/1

Let X sub 1, X sub 2,..., X sub n be an ordered sample from the standard normal population. If the r largest and r smallest observations are omitted, the range of the remaining n-2r sample values is defined as the rth quasi-range. Expressions involving multivariate normal probabilities are found for the density function, the cumulative distribution function, and the expected value. The midrange is defined. If the sample values X sub 1 and X sub n are from the standard normal population, it is possible to express the density function of the midrange in terms of multivariate normal probabilities for even values of n. Author (TAB)

N69-24444# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ON THE UNIQUENESS OF THE SOLUTIONS OF INTEGRAL VOLTERRA EQUATIONS WITH A RETARDED ARGUMENT
A. L. Logunov and Z. B. Tsalyuk Jul. 1968 13 p Transl. into ENGLISH from Mat. Sb. (Moscow), v. 67 (109), no. 2, 1965 p 303-309
(Contract NOw-62-0604)
(AD-680688; APL-CLB-3-T-559) Avail: CFSTI CSCL 12/1

On the uniqueness of the solutions of integral volterra equations with a retarded argument--translation. TAB

N69-24504# Forsvarets Forskningsanstalt, Stockholm (Sweden).
STRUCTURE INFERENCE AND STOCHASTIC GRAPHS
Ove Frank Mar. 1969 10 p refs /ts FOA Reports, v. 3, no. 2, 1969
(FOA-P-B-8008-11) Avail: CFSTI

Population structures represented by finite graphs without parallel arrows in the same direction between any pair of nodes are considered. Various structure concepts, operations on graphs and matrices, relations between different structure properties, and some structure parameters are introduced. Various sampling schemes for extracting from a portion of a graph information about the whole graph are described. Inference from the observed structure to the population structure is discussed. Examples are given to show how unbiased estimators of various structure parameters may be obtained. Multi-stage sampling and stochastic graphs are treated. Means and variations are given for some structure parameters under different assumptions about the stochastic graphs. Author

N69-24510# Research Analysis Corp., McLean, Va.
AN ALGORITHM FOR A SPECIAL CLASS OF GENERALIZED TRANSPORTATION-TYPE PROBLEMS
Ronald L. Arms Nov. 1968 60 p refs
(Contract DA-44-188-ARO-1)
(AD-680167; RAC-TP-337) Avail: CFSTI CSCL 12/2

The algorithm described in this paper is used to solve a special class of linear programming problems characterized by constraint coefficient matrices having generalized transportation structure. Specifically, n available resources are allocated to m capacity-limited operations (where the operational capability of assigning the jth resource to the ith operation is known) such as to maximize the total profit for the system. The row-and-column structure of such problems permits an algorithm more efficient than the general simplex algorithm to be used to solve moderate-sized problems (problems where loop-tracing techniques or equivalent schemes are not required). It is not required in the problem statement that all the resources be allocated or that all operations be performed to capacity limits. It is characteristic of such problems, however, that the optimizing solution usually requires that at least one of the two conditions holds, i.e., either supply or demand is exhausted. The paper contains a description of the algorithm, a computer program, an example illustrating its application, and some comparisons with the general simplex algorithm in solving the same problem. Author (TAB)

N69-24512# System Development Corp., Santa Monica, Calif.
A GENERALIZATION OF A COMBINATORIAL PROBLEM OF SMIRNOV
Ronald Alter and P.Bennet Lientz Nov. 1968 42 p refs
(AD-680108; SDC-SP-3524) Avail: CFSTI CSCL 12/1

In 1966 N.V. Smirnov proposed the following combinatorial problem: given n objects of s+1 classes; how many ways can the n objects be arranged in a chain so that adjacent objects belong to separate classes. In 1967, O.V. Sarmanov and V.K. Zaharov derived some asympotic results on this problem. The present paper extends and generalizes this work. TAB

N69-24514# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.
A UNIFIED THEORY FOR CONSTRAINED MINIMIZATION ON HILBERT SPACE
Harold O. Ladd, Jr. (Ph.D. Thesis) Jan. 1968 419 p refs
(Contract F04695-67-C-0161)
(AD-680073; T-469) Avail: CFSTI CSCL 12/2

A codification, involving new, as well as known, results from several areas of investigation of the problem of constrained minimization, is presented in a unified geometric treatment. Specifically, a unified theory is given for the local minimization of a smooth functional phi(u), subject to a set of q smooth functional equality constraints psi(sub k) (u) = 0, phi and the psi(sub k) being defined on a Hilbert space H. There are two complementary theories. Author (TAB)

N69-24529# Auburn Univ., Ala.
A FAST ALGORITHM FOR BOOLEAN FUNCTION MINIMIZATION
Chester C. Carroll and George E. Jordan Dec. 1968 43 p refs
(Contract DAAH01-68-C-0296)
(AD-680305; AU-T-3) Avail: CFSTI CSCL 12/1

The structure of the cellular n-dimensional cube is studied with emphasis placed on containment of vertices by cells. The isomorphic relation between the cells of the n-Cube and the products of a Boolean function is discussed. A computer oriented algorithm is derived in terms of the cellular representation for the generation of prime implicants for Boolean functions. Time consuming numerical calculations are replaced by logical operations and storage of terms is limited to minterms and prime implicants. Author (TAB)

N69-24541# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
NUMERICAL SOLUTION OF THE DIRICHLET PROBLEM FOR LAPLACE'S EQUATION
N. S. Bahvalov Aug. 1968 46 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. II: Khim. (Moscow), v. 14, no. 5, 1959 p 171–195
(Contract NOw-62-0604)
(AD-680683; APL-CLB-3-T-557) Avail: CFSTI CSCL 12/1

The author gives asymptotic estimates for the minimum number of arithmetic operations needed to numerically solve the Dirichlet problem for Laplaces equation as a function of accuracy. In the course of proving these estimates, he gives error estimates that exhibit an increase in accuracy near the boundary, for difference schemes which are of positive type and satisfy certain additional conditions. The author constructs difference schemes which are locally low-order accurate on a fine mesh near the boundary and locally high-order accurate on a coarse mesh away from the boundary. He then shows that the number of arithmetic operations required to solve the resulting system of equations by iteration to the desired accuracy is asymptotically of the same order as the minimum possible, and thus is in that sense optimal. TAB

N69-24551# System Development Corp., Santa Monica, Calif.
THE HIDE AND SEEK GAME OF VON NEUMANN
Merrill M. Flood 23 Dec. 1968 10 p refs
(AD-680107; SP-3274) Avail: CFSTI CSCL 12/2

John von Neumann has discussed a zero-sum two-person game and he has shown the extreme optimal strategies for one of the players (the hider) can be calculated by solving a related assignment problem. An alternative treatment of the problem is now offered that is simpler and easily yields optimal strategies for both players. Author (TAB)

N69-24559# Texas Univ., Austin. Computation Center.
STABILIZING AVERAGES FOR MULTISTEP METHODS OF SOLVING ORDINARY DIFFERENTIAL EQUATIONS Interim Technical Report
John M. Thomeson Sep. 1968 87 p refs
(Grants DA-ARO(D)-31-124-G721; NSF GP-5253)
(AD-680199; ITR-18; AROD-3772-40-M) Avail: CFSTI CSCL 12/1

In 1959 Milne and Reynolds described a technique of stabilizing averages for damping out the increasingly disruptive oscillations of the error associated with certain multistep methods for solving ordinary differential equations numerically. In 1962 Timlake published a constructive proof of the fact that stabilizing averages exist for all conditionally stable multistep methods and in particular, he proved the existence of stabilizing averages for Milnes

method which reduce by a factor of theeta(h superscript(2k+1)) the dominative component of the truncation error expression for any non-negative integer k. Numerical experiments were carried out to verify Timlakes theoretical results and the results are presented in this report. Author (TAB)

N69-24674# Royal Aircraft Establishment, Farnborough (England).
THE GREEN'S FUNCTION OF THE WAVE-MECHANIC KEPLER PROBLEM [DIE GREENSCHE FUNKTION DES WELLENMECHANISCHEN KEPLERPROBLEMS]
J. Meixner Oct. 1967 43 p refs Transl. into ENGLISH from Z. Math. (West Ger.), no. 38, 1933 p 677–707
(RAE-Lib-Trans-1251) Avail: CFSTI

The article defines the Green's function and its development from eigenfunctions, the significance of Green's function for the continuous spectrum and wave mechanic electron flow, and also its application to the one and three dimensional wave-mechanic Kepler problem. Integral representations, expressions for large and small values of the argument x, recurrence formulae, addition theorems, and generating functions of the degenerate (or confluent) hypergeometric function are also discussed. Author

N69-24672# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics.
ASYMPTOTIC THEORY OF A CLASS OF TESTS FOR TESTS FOR UNIFORMITY OF A CIRCULAR DISTRIBUTION
R. J. Beran Nov. 1968 23 p refs Revised
(Contract Nonr-4010(09))
(AD-680451; TR-78-Rev) Avail: CFSTI CSCL 12/1

Let (x sub 1, x sub 2,..., x sub n) be independent realizations of a random variable taking values on a circle C of unit circumference T sub n = (1/n) the integral from 0 to 1 of the quantity (Summation from j=1 to j=n of f(x + x sub j)-n) squared dx, where f(x) is a probability density on C, f epsilon L sub 2 (0,1), and the addition x +(x sub j) is performed modulo 1. T sub n is used to test whether the observations are uniformly distributed on C. It includes as special cases several other statistics previously proposed for the purpose by Ajne, Rayleigh and Watson. The main results of the paper are the asymptotic distributions of T sub n under fixed alternatives to uniformity and under sequences of local alternatives to uniformity. Author (TAB)

N69-24687# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
A NOTE ON THE EVALUATION OF A MULTIVARIATE NORMAL INTEGRAL BY THE METHOD OF DAS
J. T. Webster 3 Dec. 1968 8 p refs
(Contract N00014-68-A-0515; Proj. Themis)
(Themis-SMU-TR-15) Avail: CFSTI CSCL 12/1

Das (1956) presents a method of evaluating the integral I = the integral from a sub 1 to infinity ... the integral from a sub n to infinity of f(x sub 1, x sub 2, ..., x sub n) (dx sub 1)(dx sub 2)...(dx sub n) (where f(x sub 1, x sub 2, ..., x sub n) is the joint multivariate normal density function with zero means and nonsingular variance-covariance matrix sigma) through the combining of a + k independent normal variables with zero means and unit variances. Later Marsaglia (1963) shows that this is a special case of a convolution formula. The complexity of implementing the solution is highly dependent upon the size of k and Marsaglia (1963) notes that k equal to n minus the multiplicity of the smallest latent root of sigma can always be achieved. This note investigates properties of sigma that will allow smaller values of k. Author (TAB)

N69-24675# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
APPROXIMATE DISTRIBUTIONS FOR LARGEST AND FOR SMALLEST OF A SET OF INDEPENDENT OBSERVATIONS
John E. Walsh Sep. 1968 15 p refs
(Contract N00014-68-A-0515)
(AD-680018; SMU-TR-10) Avail: CFSTI CSCL 12/1

There is often interest in whether the largest observation of a set of n independent observations is unusually large, or the smallest observation is unusually small. Quite accurate approximate probability expressions can be developed for relations of this kind, even though the distributions for the individual observations can be arbitrarily different and all n = or > 1 are considered. More specifically, let X sub n and X sub 1 denote the largest and smallest observations, respectively. Approximate expressions are developed for P(X sub n = or < x) and P(X sub 1 = or < x) that are very accurate if 1 - P(X sub n = or < x) = or < 0.15 and P(X sub 1 = or < x) = or < 0.15. Author (TAB)

N69-24685# Oak Ridge National Lab., Tenn.
EXTRAPOLATION ALGORITHM FOR SPECIAL ORDINARY INITIAL VALUE PROBLEMS BASED ON AN ELEMENTARY TRIGONOMETRIC MULTISTEP FORMULA
C. E. Hammons June 1968 64 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2166) Avail: CFSTI

It was desired to know if a trigonometric analog to a classical method for the solution of special second order initial value problems would provide a better approximation to the exact solution for those problems whose solutions are periodic in nature and to see if the analog could be defined in such a manner that extrapolation to the limit could be justified. The analog was defined to be exact for certain trigonometric monomials and, under suitable hypotheses on the initial value problem, was shown to be convergent. It was also shown to have an asymptotic expansion in even powers of the step, h, under these hypotheses. These results provide a justification for extrapolation to the limit by means of the Neville algorithm. Some numerical results were obtained to verify these results experimentally. Author (NSA)

N69-24688# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
ON THE ANALYSIS OF TRIANGULAR DESIGNS
C. H. Kapadia Sep. 1968 7 p ref
(Contract N00014-68-A-0515)
(AD-680434; TR-12) Avail: CFSTI CSCL 12/1

The note gives an alternate formula for computing the adjusted treatment sum of squares for Triangular Partially Balanced Incomplete Block Designs. The proposed formula is shown to be equal to one which is given by Bose, Clatworthy, and Shrikhande, and hence a check is provided in carrying out the computations. Author (TAB)

N69-24716# California Univ., Los Angeles. Dept. of Mathematics.
A REPRESENTATION THEOREM FOR DISTRIBUTION SEMI-GROUPS
H. O. Fattorini 1968 22 p refs
(Contracts Nonr-233(76); DA-31-124-ARO(D)-355)
(AD-680250) Avail: CFSTI CSCL 12/1

The report obtains a result which is a simple consequence of the characterization of the infinitesimal generators of distribution semigroups due to Chazerain. An application to the approximation of distribution solutions of differential equations is indicated. Author (TAB)

N69-24722# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
GENERALIZATION OF RATIO ESTIMATE FOR POPULATION TOTAL
John E. Walsh Oct. 1968 16 p ref
(Contract N00014-68-A-0515; Proj. Themis)
(AD-680438; TR-16) Avail: CFSTI CSCL 12/1

It is desired to estimate the total Y for a finite population (of size N) with unknown values. A population with corresponding known values is available. Also, a simple random sample of size n is taken from the unknown population. Let y bar be the mean of the sample while x bar is the mean of the n values from the known population that correspond to these sample values. The ratio estimate of Y is generalized to the form N(X bar)(y bar)/(A(x bar)+(1-A)X bar)), where X bar is the mean of the known population. Use of A = A sub o suitably chosen, yields an estimate that approximately is unbiased and has as small a variance as is attainable for a linear regression estimate. When A sub o is unknown in advance, it can be estimated (denoted by A sub o). An estimate is developed for the standard deviation of the estimate using A sub o. Also, an estimate is obtained for the standard deviation of this estimate for the standard deviation. Finally, some comparisons are made with the linear regression estimate.
Author (TAB)

N69-24743# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
SAMPLE SIZE REQUIRED TO ESTIMATE A PARAMETER IN THE POWER FUNCTION DISTRIBUTION
R. E. Kromer and C. H. Kapadia Sep. 1968 11 p refs
(Contract N00014-68-A-0515)
(AD-680435; TR-13) Avail: CFSTI CSCL 12/1

The purpose of the paper is to establish a two step sampling procedure for estimating the parameter theta of the power function distribution to within given d units of its true value with a given probability 1 - alpha; (0 < alpha < 1). The density of the power function distribution is a function of two parameters, the second of which k is assumed known. It is demonstrated that an exact solution for all values of theta does not exist based on the maximum likelihood estimator. Given a preliminary sample size m, tables and formulas are presented by which one may establish the size n of the second sample such that P(absolute value of (y sub n - theta) < d) >1 - alpha is true, where y sub n is the largest observation in the second sample. The method used in deriving the results of this paper is similar to that given by Graybill and Connell and since the power function density reduces to the uniform density when k = 0, their results can be derived from the formulas given here. Also a table of comparisons between the expected second sample size in this paper and two other solutions is given.
Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N69-23651# Israel Program for Scientific Translations, Ltd., Jerusalem.
RAINSTORMS AND HAIL
G. K. Sulakvelidze 1969 330 p refs Transl. into ENGLISH of the book "Livnevye Osadki i Grad" Leningrad, Gidrometeoizdat., 1967 Published for NSF
(TT-68-50466) Copyright. Avail: CFSTI

CONTENTS:

1. VERTICAL CURRENTS IN CONVECTIVE CLOUDS p 1-49 (See N69-23652 12-20)
2. LIQUID-WATER CONTENT OF A CONVECTIVE SHOWER CLOUDp 50-120 (See N69-23653 12-20)
3. RADAR INVESTIGATIONS OF CONVECTIVE CLOUDS p 121-168 (See N69-23654 12-20)
4. FORMATION MECHANISM OF SHOWERS AND HAIL p 169-227 (See N69-23655 12-20)
5. METHODS OF MODIFYING HAIL PROCESSES p 228-287 (See N69-23656 12-20)

N69-23652# Israel Program for Scientific Translations, Ltd., Jerusalem.
VERTICAL CURRENTS IN CONVECTIVE CLOUDS
In its Rainstorms and Hail 1969 p 1-49 (See N69-23651 12-20)
Copyright. Avail: CFSTI

Briefly reviewed are theoretical investigations into the occurrence of ascending currents in cumulus clouds and of experiments to study vertical currents in both, cloudless atmospheres and within convective clouds. Evaluated data on magnitude and velocity distribution of vertical currents at different heights show that the ascending current velocity in developing convective clouds increases with height, reaches a maximum value in the middle or near the top of the cloud and then falls; wind shear and other factors do not alter substantially the ascending current velocity, which is determined mostly by thermal instability.
G.G.

N69-23653# Israel Program for Scientific Translations, Ltd., Jerusalem.
LIQUID-WATER CONTENT OF A CONVECTIVE SHOWER CLOUD
In its Rainstorms and Hail 1969 p 50-120 (See N69-23651 12-20)
Copyright. Avail: CFSTI

The collection efficiency in the accretion of cloud particles of different sizes is considered in relation to the formation of accumulation zones which produce showers. Experimental work together with a literature review shows that water accumulates in a cloud only when the maximum ascending current velocity exceeds the critical velocity. The accumulation zone forms in the upper part of the cloud where the liquid-water content may reach 20 to 40 g/m^3. Growth of large cloud particles is mainly due to coalescence of particles of comparable size. The amount of precipitation is determined by the square of the maximum ascending current velocity.
G.G.

N69-23654# Israel Program for Scientific Translations, Ltd., Jerusalem.
RADAR INVESTIGATIONS OF CONVECTIVE CLOUDS
In its Rainstorms and Hail 1969 p 121-168 (See N69-23651 12-20)
Copyright. Avail: CFSTI

Radar reflectivity was used to study the microstructure of convective clouds and the formation and fall of precipitation. Reflected signals were displayed on a cathode ray tube, automatically photographed, and their intensity correlated with target distance. This display was also used to calculate the size of hail particles in a cloud, to find the concentration of hailstones and the hail spectrum, as well as the position of the region giving the maximum radio-echo intensity.
G.G.

N69-23655# Israel Program for Scientific Translations, Ltd., Jerusalem.
FORMATION MECHANISM OF SHOWERS AND HAIL
In its Rainstorms and Hail 1969 p 169–227 (See N69-23651 12-20)
Copyright. Avail: CFSTI

Considered were synoptic aerological conditions in which hail situations arise and the mechanism of hail formation. A literature review and evaluation of experimental data established the following: (1) hail processes are most probable at the boundary of jet streams in a highly unstable atmosphere; (2) hail cloud appearances are determined by the effects of topography on the development of atmospheric processes and are seasonal limited; and (3) hail cloud precipitation has an average duration of 1.5 to 2.5 hrs. During hail and rain showers the liquid-water content of the cloud is completely renewed 3 to 5 times on the average. Hail cannot fall when: (1) the maximum ascending current velocity is lower than 10 m/sec; (2) the level of the maximum ascending current velocity is below the 0° isotherm; and (3) the point of maximum ascending current velocity and air temperature is at a height where the temperature of the cloud air is lower than the limiting temperature at which moist hail growth can take place. G.G.

N69-23656# Israel Program for Scientific Translations, Ltd., Jerusalem.
METHODS OF MODIFYING HAIL PROCESSES
In its Rainstorms and Hail 1969 p 228–287 (See N69-23651 12-20)
Copyright. Avail: CFSTI

Concepts of the hail formation mechanism are used to develop two hail control methods in order to reduce hail damage to agricultural crops. One method introduces the crystallizing agents into the large-drop zone of the hail cloud whereas the other seeds only the hail focus of the cloud. Both methods increase hail control effectiveness because the introduced reagent is not deactivated on its way from the ground to the cloud by solar radiation or warm drops in the lower part of the cloud and, also, the reagent concentration in the hail foci is sharply raised. G.G.

N69-23713# Hamburg Univ. (West Germany). Instituts fuer Radiometeorologie und Maritime Meteorologie.
AIRCRAFT MEASUREMENTS OF REFRACTIVE INDEX AND TEMPERATURE IN THE RANGE OF RADIO TRANSHORIZON LINKS OVER SEA [MESSUNGEN DER BRECHUNGSINDEX-UND TEMPERATURSCHICHTUNG IM BEREICH VON RICHTFUNKSTRECKEN. ERGEGNISSE VON FLUGZEUGAUFSTIEGEN UEBER DER DEUTSCHEN BUCHT]
H. Mueller 1968 71 p refs In ENGLISH and GERMAN *Its* No. 12
Avail: CFSTI

This report deals with refractive index and temperature measurements conducted during the fall 1962 over the Bay of Heligoland. The refractive index was measured by a microwave refractometer of NBS type, model 3 A, the temperature by a platinum resistance thermometer. Static and dynamic pressure (determination of altitude and speed of the aircraft) were also measured by special pressure transducers. The equipment, the calibration of the instruments and the methods of evaluation are described. Vertical temperature and refractive index profiles up to 10,000 ft were obtained under the following weather conditions: (1) advection of subtropical air masses over a cooler sea surface resulting in the formation of a ground duct; (2) strong anticyclone located over central Europe; and (3) rear of a depression, weakened by anticyclonic influence. Author

N69-23820# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ADDITIONAL METEOROLOGICAL ANALYSES OF SHOT SMOKY, PLUMBBOB TEST SERIES
W. E. Davis, C. A. Oster, B. C. Scott, and J. M. Thorp *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 74–88 refs (See N69-23812 12-13)
Avail: CFSTI

An analysis of the effect of meteorological conditions on the transport and deposition of fallout from Shot Smoky, an August 31, 1957 nuclear explosion at the Nevada Test Site, was undertaken to explain discrepancies between predicted and measured data. The original meteorological data were found to contain errors. Deletion of these errors resulted in a computed cloud travel path which was in spatial and temporal agreement with aircraft observations. 1967 to 1968 Shot Smoky research demonstrated that: a correlation of isentropic trajectories of the nuclear debris cloud with meteorological observations of precipitation could explain measured high values in the surface deposition pattern near Rock Springs, Wyoming; the isentropic trajectory technique can predict cloud travel in space and time; and the DELFIC computer program can be used to compute the close in (<200 km) deposition patterns for Shot Smoky with an accuracy of deposition centerline location of within 5 km up to a distance of 170 km. NSA

N69-23835# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SOME ENVIRONMENTAL CONSEQUENCES OF SHADING IN SHRUB COMMUNITIES
W. T. Hinds *In its* Ann. Rept. for 1967 to USAEC Div. of Biol. and Med., vol. 2, pt. 3 Oct. 1968 p 184–190 refs (See N69-23812 12-13)
Avail: CFSTI

The thermal environment around shrubs was studied to determine the effects of shade on soil and air. Soil temperature measurements were made near a multi-stemmed desert-steppe shrub. The results showed that shrubs induce a wide variety of alterations in their immediate environment and many provide a community scale alteration in the earth–air energy exchange mechanism. NSA

N69-23857# Joint Publications Research Service, Washington, D. C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 201 1 Apr. 1969 p 16–43 (See N69-23855 12-34)
Avail: CFSTI

News items are presented for: a study of aerosols in a free atmosphere, organization of long range weather forecasting, an aircraft instrument for measuring the water content of rain, work at the world meteorological center, evaporation from rain gages, a thermoelectrolytic hygrometer, atmospheric circulation over the northern and southern hemispheres, hydrometeorological instruments construction, aerologic radiosondes, and hail prevention. Abstracts include: equations of Brownian motion of aerosol particles, determination of albedo variations from satellites, time spectra of atmospheric characteristics over the ocean, long range weather forecasting possibilities, radioactive fallout effects on atmospheric electricity, hailstone melting with liquid film, random error estimates in total ozone content, cyclone evolution, atmospheric data processing algorithms, spectral brightness of clouds, representation of geopotential and temperature profiles by eigenvectors, statistical structure of pressure field over mountains, logic and probability analysis in weather forecasting, lightning parameters, sleeting phenomena, billowing clouds, convective cloud cells, infrared cloud cover images from satellites, and particle spectrum, particle density, and continuous precipitation calculations. P.A.B.

N69-23933# Weather Bureau, Silver Spring, Md.
AN ANNOTATED BIBLIOGRAPHY ON THE CLIMATE OF FRENCH SOMALILAND
Charles S. Vitale Dec. 1968 40 p refs
(AD-680446; WB/BC-101) Avail: CFSTI CSCL 4/2

The bibliography is one of a continuing series prepared at irregular intervals by the Foreign Branch, Climatology Division, Environmental Data Service. It has been compiled from available sources with climatological and meteorological data for French Somaliland in the Atmospheric Sciences Library, Library of Congress the U.S. Naval Oceanographic Library and the files of the Foreign Branch, Environmental Data Service, ESSA. Author (TAB)

N69-24043# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRODYNAMIC PROGNOSIS OF METEOROLOGICAL ELEMENTS IN THE TROPOSPHERE AND LOWER STRATOSPHERE WITH CONSIDERATION OF RADIATION AND TURBULENT HEAT CONDUCTIVITY
M. S. Galin Feb. 1968 18 p Transl. into ENGLISH from Tr. Mirovoi Meterorol. Tsentr. (Moscow), no. 5, 1965 p 25–34
(AD-682769; FTD-HT-23-1287-67) Avail: CFSTI CSCL 4/2

A quasi-solinoidal, four-level atmospheric model is studied in detail. The earths spherical surface is divided into four pressure levels: 50, 150, 250, and 950 millibars. A momentum vorticity transport and an energy equation are given including radiation heat transfer. Author (TAB)

N69-24084# National Weather Records Center, Asheville, N. C.
DATA REPORT. METEOROLOGICAL ROCKET NETWORK FIRINGS, VOLUME 8, NUMBER 8
Aug. 1968 210 p Sponsored by NAS-NRC
Avail: SOD $3.00

The meteorological rocket data reports issued monthly contain the wind and temperature measurements from all available meteorological sounding rocket firings for that particular month, along with computed values for pressure, density, and speed of sound and also include the local radiosonde observations nearest the time of firing. Since only those firings which yield significant data are of interest here, the report does not include unsuccessful firings. Prior to January 1966, only data from stations cooperating in the current Meteorological Rocket Network (MRN) are available. Thus these first issues of the meteorological rocket data reports are essentially a reprint of the data report of the meteorological rocket network firings issued by the meteorological rocket network committee (MRNC). Author

N69-24199# Israel Program for Scientific Translations, Ltd., Jerusalem.
METEOROLOGICAL AND ACTINOMETRIC OBSERVATIONS
G. I. Kizino et al *In its* The Sixth Voyage of R/V, "Ob" 1968 p 201–228 (See N69-24191 12-13)
Avail: CFSTI

Observations were made of atmospheric pressure, air and water temperatures, air humidity, cloudiness, wind speed and direction, atmospheric phenomena, visibility, and sea surface conditions. A tabulated summary of these meteorological phenomena is provided. The total and the reflected radiation and the radiation balance were also measured. The intensity of radiation fluxes was continuously recorded with an electronic potentiometer. Actinometric results are shown in the form of diurnal sums of total and reflected radiation. B.P.

N69-24203# California Univ., Davis. Dept. of Agricultural Engineering.
ANALYSIS IN TRANSFERS OF ENERGY, MOMENTUM AND MOISTURE NEAR THE GROUND Final Report, 1968
Frederick A. Brooks, W. B. Goddard, and A. T. McDonald Aug. 1968 55 p refs
(Contract DA-AMC-28-043-66-G26)
(AD-680310; ECOM-66-G26-F) Avail: CFSTI CSCL 4/2

Half-hourly averages of field measurements of flux rates of heat, momentum and evapotranspiration and their corresponding temperature, airspeed and moisture profiles are subjected to analysis and the resulting transfer processes described. Non-advective Australian wind velocity profile data is computer fit to four profile formulas. An analysis of the goodness of fit for each formula is undertaken. The relationship between interpretations based on measured shear stress and shear stress calculated from wind profiles is subjected to analysis. Diurnal variations of the drag coefficient, z and d and their resultant effects on the shear stress is discussed. Evaluation of the phi function of diabatic profiles in terms of the binomial profile constants is developed. The gap between the conventional engineering analysis of fluid flow over rough surfaces and the atmospheric boundary layer is tenatively bridged. The development of the drag coefficient and roughness height calculated from velocity profiles results from the analysis. Sensible heat flux measurements made during 1966 with the CSIRO Evapotron are presented. Author (TAB)

N69-24302# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
AMSS PROTOTYPE RADIOSONDE Final Report, 1 Jul. 1967–1 Sep. 1968
Warren M. Griggs Sep. 1968 49 p refs
(Contract F19628-67-C-0319)
(AD-680409; AFCRL-68-0475; Rept-3360-1) Avail: CFSTI CSCL 4/2

The report summarizes and reports the development and laboratory testing of the prototype Advanced Meteorological Sounding System (AMSS) Radiosondes. The Radiosondes provide telemetry of three time-shared and one continuous meteorological parameters from altitudes to 46 km. The received uplink signal is 403 MHz frequency modulated with ranging information. The 1680 MHz downlink is phase modulated with the telemetry and range information. Transmitter power is 35 milliwatts. The low cost sonde is packaged in a foam case and weighs 1.6 lbs., excluding battery. The design and hardware implementation to meet the design goals are discussed in detail, and the significant test results are given in graphic form. Author (TAB)

N69-24377# Environmental Technical Applications Center (Air Force), Washington, D. C.
WORLD-WIDE AIRFIELD SUMMARIES. VOLUME 9: PART 1: AFRICA (NORTHERN HALF)
Dec. 1968 585 p refs
(AD-680433) Avail: CFSTI CSCL 4/2

The volume provides climatological summaries for airfields and climatic areas in Africa (Northern Half). The summaries are presented by country (in alphabetical order, using a two-letter code) as shown in the Index. Within the countries, summaries are arranged according to numbered climatic areas, and by increasing WMO Station Index Numbers within the climatic areas. An arbitrary station number is used where WMO Index Numbers are not assigned. Maps are included to delineate areas and station locations. Climatic areas have been selected as being nearly homogeneous climatologically, but considerable variation may exist between locations in an area at a specific time because of topography and other factors. Climatological summaries for these areas follow those for the included airfields. Author (TAB)

N69-24392# Analysis and Computer Systems, Inc. Burlington, Mass.
DEVELOPMENT OF NON-NUMERICAL SYSTEMS AND DATA REDUCTION IN SUPPORT OF AIR FORCE CAMBRIDGE RESEARCH LABORATORIES
Donald J. Armstrong, James F. Atkinson, Ruth A. Birtwell, Jean B. Chin, and Anthony J. Spuria Sep. 1968 114 p refs
(Contract AF 19(628)-6144)
(AD-680417; AFCRL-68-0596; SR-2) Avail: CFSTI CSCL 4/2

The report records the status and progress of Scientific Analytical Investigations, the preparation of computer programs, data reduction, and the development of Non-Numeric Systems in support of Environmental research and pertinent aspects of the physical sciences. During the year covered by this report, the 60 completed programs ranged in complexity and size from conversion of programs from one language or computer system to another, up to analysis and development of a large system of programs.
Author (TAB)

N69-24452# Environmental Technical Applications Center (Air Force), Washington, D. C.
THE AIR WEATHER SERVICE FY 1968 WEATHER MODIFICATION PROGRAM. VOLUME 1. PROJECTS: WARM FOG, COLD FOG, FOG III, COLD WAND, COLD HORN, AND COLD FAN Final Report
Scott AFB, Ill. AWS Nov. 1968 54 p refs
(AD-680424; AWS-TR-209-Vol-1) Avail: CFSTI CSCL 4/2

The report includes final reports of five separate fog-dispersion tests conducted by AWS personnel during the winter of 1967-1968. One project (WARM FOG) involved fog temperatures above 32F; four projects (COLD FOG III, COLD WAND, COLD HORN, and COLD FAN) dealt with supercooled fogs. Each project is reported separately with conclusions and results summarized for all except Project COLD FOG III.
Author (TAB)

N69-24462# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPACE METEOROLOGISTS
M. Andronov May 1968 7 p Transl. into ENGLISH from Pravda (Moscow), 26 Oct. 1967 p 3
(AD-680349; FTD-HT-23-1574-67) Avail: CFSTI CSCL 4/2

The Soviets have created the Meteor meteorological system which has for more than a half-year provided information characterizing the weather situation over the entire globe. The first research satellites were the Cosmos 14 and Cosmos 23. Experimental equipment development tests were carried out for the entire system; the results were embodied in the Cosmos 122 launched 25 June 1966. Cosmos 144 and Cosmos 156 were launched 28 February and 27 April 1967, respectively. The weather satellites have solved scientific problems related to space engineering. They have demonstrated the feasibility of protracted, stable solar battery performance in space and under sharply fluctuating temperature conditions and thermal shocks when entering and leaving shadowed areas.
Author (TAB)

N69-24592# Litton Systems, Inc., Monterey, Calif. Mellonics Systems Development Div.
THREE-DIMENSIONAL DIGITAL OCEAN CLIMATOLOGY FOR THE WESTERN NORTH ATLANTIC
S. W. Selfridge, William Woodworth, and Kenneth G. Richards Feb. 1968 103 p refs
(Contract N62306-68-C-0049)
(AD-680055) Avail: CFSTI CSCL 4/2

A three-dimensional ocean climatology of the western north Atlantic off the U.S. east coast. Monthly means are presented for the sea surface and 200 and 400 ft. temperatures and the mixed layer depth. Seasonal and monthly temperature profiles are presented for selected locations within the regional analysis area. The climatology was derived from Naval Oceanographic Office, Scripps Institute and Woods Hole Oceanographic Institute data.
Author (TAB)

N69-24634# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINING SURFACE TEMPERATURE AND CLOUD TEMPERATURE FROM METEOROLOGICAL EARTH SATELLITES
K. Ya. Kondratev, E. P. Novoseltsev, and N. E. Ter-Markaryants Jun. 1968 35 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 196, 1966 p 3–23
(AD-680579; FTD-MT-24-88-68) Avail: CFSTI CSCL 4/2

The factors which are responsible for errors in surface temperature and cloud temperature measurements from artificial earth satellites are considered for various spectral intervals (3.5-4.0; 8.0-12.0 microns). The radiation temperature is computed for 25 locations in the USSR during different seasons and this information is used to propose the most probable corrections to the temperature of the surface measured from meteorological satellites.
Author (TAB)

N69-24668# Weather Wing (4th), Ent AFB, Colo. Aerospace Sciences Div.
MARCH WEATHER ALONG THE 7 MARCH 1970 ECLIPSE PATH FROM NANTUCKET TO NEWFOUNDLAND Climatology Study
Clarence E. Everson 16 Dec. 1968 8 p refs
(AD-680426; SS-1836) Avail: CFSTI CSCL 4/2

The report describes weather conditions in March over the 7 March 1970 eclipse path from Nantucket to Newfoundland. Although the picture presented appears rather unfavorable for solar eclipse research activity, there are days in March with sunshine and relatively cloud free skies. However, the chances are about 2 to 1 against sunshine conditions.
Author (TAB)

N69-24698# Eagle-Picher Co., Miami, Okla. Research Labs.
RESEARCH IN PURIFICATION AND SINGLE GROWTH OF II-VI COMPOUNDS Progress Report, 1 Jan.–31 Mar. 1969
R. H. Fahrig, C. R. Porter, and G. N. Webb 31 Mar. 1969 39 p
(Contract F33615-67-C-1575)
(PR-4) Avail: CFSTI

A study of the synthesis, purification, and crystallization of Group 2 and 6 compounds semiconductor materials is presented. A series of test runs were made on the synthesis of cadmium sulfide using differently prepared starting materials. One test used double distilled cadmium and other tests were made with a sulfur obtained from a new source. Purity of the cadmium sulfide synthesized in these tests was quite good with one lot achieving the highest purity reported by mass spectrographic analyses. A group of small quantity syntheses of CdS were made in sealed ampoules and several vapor phase crystal growth runs were made using these sealed ampoules. Zinc selenide syntheses were carried out and a method of reclaiming selenium from terminated selenide runs was devised.
Author

N69-24704# White Sands Missile Range, N. Mex. Atmospheric Sciences Research Office.
A STUDY OF WIND AND TEMPERATURE VARIABILITY AT WHITE SANDS MISSILE RANGE, NEW MEXICO
Laurence J. Rider, Manuel Armendariz, and Frank V. Hansen Sep. 1968 40 p refs
(AD-680172; ECOM-5219) Avail: CFSTI CSCL 4/2

Four cases of variation of wind and temperature over periods of approximately 12 hours in the first 152 meters of the planetary boundary layer are examined in some detail. An effort is made to explain some observed marked changes in wind and temperature which may not be apparent on the usual synoptic chart because of their mesoscale or microscale characteristic. Author (TAB)

N69-24717# Deutscher Wetterdienst, Offenbach am Main (West Germany).
MONTHLY AND ANNUAL LATITUDINAL AVERAGES OF ATMOSPHERIC PRESSURE IN THE NORTHERN HEMISPHERE FOR THE PERIOD 1899 THROUGH 1967 [MONATLICHE UND JAEHRLICH BREITENKREISMITTEL DES LUFTDRUCKS AUF DER NORDHALBKUGEL FUER DIE JAHRE 1899 BIS 1967]
Erwin Dinies 1968 18 p refs In GERMAN; ENGLISH summary *Its* Ber. nr. 109, band 15
(DK-551.542) Avail: CFSTI

Tables are presented which contain the average monthly and annual deviations of the parallels of latitude 20° to 90° on the Northern Hemisphere. A third table contains the deviations from the normal values of the zonal index between 35° and 65° Author

N69-24718# Deutscherwetterdienst, Offenbach am Main (West Germany).
COHERENCE ANALYSIS OF PRECIPITATION AND WATER TEMPERATURE IN THE TROPICAL REGION OF THE PACIFIC OCEAN [KOHAERENZANALYSE VON NIEDERSCHLAG UND WASSERTEMPERATUR IN TROPISCHEN PAZIFISCHEN OZEAN]
Rolf Doberitz 1968 52 p refs In GERMAN; ENGLISH Summary *Its* Ber. nr. 112 band 15
(DK-551.501.45) Avail: CFSTI

Teleconnections and phase relationships of 35 rainfall and a few sea temperature series in the tropical Pacific region for the period 1890–1965 are investigated by means of cross spectrum analysis. Main interest is directed toward anomalies in the dry equatorial belt. Comparison of rainfall spectra was simplified by defining some spectrum types. The cross spectra reveal a region at the Pacific along the equator extending from the west coast of South America towards 165°E where all stations give mutually significant coherencies. Significant phase relations are exhibited by the annual cycle and periodicities above two years. The latter indicate a southward propagation of anomalies in the dry region. Cross spectra between rainfall and sea temperature generally exhibit either a simultaneous march of anomalies or a small time lag of sea temperature after rainfall. The results suggest a dominant role of atmospheric circulation processes causing anomalies of rainfall and sea temperature in the equatorial Pacific region. Author

N69-24719# Deutscherwetterdienst, Offenbach am Main (West Germany).
THE CLIMATE TOWARD THE END OF THE 16TH AND BEGINNING OF THE 17TH CENTURY AS OBSERVED BY TYCHO de BRAHE ON HVEN, LEONHARD III TREUTTWEIN IN FUERSTENFELD, AND DAVID FABRICIUS IN EAST FRIESLAND [DAS KLIMA ENDE DES 16. UND ANFANG DES 17. JAHRHUNDERTS NACH BEOBACHTUNGEN VON TYCHO DE BRAHE AUF HVEN, LEONHARD III. TREUTTWEIN IN FUERSTENFELD UND DAVID FABRICIUS IN OSTFRIESLAND]
Walter Lenke 1968 49 p refs In GERMAN; ENGLISH Summary *Its* Ber. nr. 110, Band 15
(DK-551.506.2) Avail: CFSTI

Besides the observation series of Tycho de Brahe (1582–1597) which has already been examined, the two series of Leonhard III von Fürstenfeld (1587–1593) and David Fabricius (1586–1612) receive particular treatment. These three series are of a special climatological importance as they fall before and between the advances of the glaciers whose existence in the Eastern and Western Alps between 1600 and 1650 was proved. They are said to be in connection with a preceding weather deterioration. The question whether such weather conditions can be proved by observations made before any instruments were available, has to be answered in the affirmative. In spite of the considerable distances between the places of observation all three studies agree in that they show that frequent easterly flow patterns in the winter month brought colder and snowier climate compared with modern times. The summer months were on an average marked by rather unsettled weather and evidently a cooler climate with very frequent west, northwest and north winds. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N69-23463 State Univ. of Iowa, Iowa City.
AN OPTIMUM DOPPLER-SATELLITE INERTIAL NAVIGATION SYSTEM
Larry Leon Hagerman (Ph.D. Thesis) 1968 51 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-14795

An optimum method for correcting the long-term drift of an inertial system is presented. It is accomplished by augmenting the inertial system with doppler information from an orbital satellite. The conventional means of accomplishing this augmentation is to provide the inertial system with a position fix from an orbital satellite and use this position fix to reset the inertial position. It is shown that a "frequency fix" has several advantages over a "position fix" from an orbital satellite. It is also shown that when doppler frequency is used as the observable, a non-inertial velocity reference is no longer needed. In comparing the system response (bounded azimuth error, east-west gyro drift, and position error) with and without a velocity reference, it is found that there is very little gain in system accuracy when a non-inertial velocity reference is present. Dissert. Abstr.

N69-23718# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
A COMPARATIVE STUDY OF AIR TRAFFIC TRAINEE APTITUDE-TEST MEASURES INVOLVING NAVY, MARINE CORPS AND FAA CONTROLLERS
Bart B. Cobb Sep. 1968 21 p refs
(AM-68-14) Avail: CFSTI

This study concerns the experimental use of several commercially-published aptitude tests and a determination of their validity as predictors of training-performance grades for more than

300 Marines and over 600 Naval students who entered the basic air-traffic-controller (ATC) training course at the Glynco Naval Air Station during 1966 and 1967. All the tests were selected from a group for which validities had been established through previous and similar research involving former ATC trainees of the Federal Aviation Administration (FAA). Scores for nearly 400 of these former FAA-ATC trainees, who took the tests on an experimental basis, were included in the study for comparative purposes. The results indicated that a composite score involving only four of the tests could be used to effectively predict performance grade and pass-fail status for the Glynco training course. Author

N69-24268# Aeronautical Research Council (Gt. Brit.)
THE PILOT'S SAFETY PROBLEM IN CATEGORY 2 OPERATIONS AND THE POTENTIAL CONTRIBUTION OF HEAD-UP DISPLAY. INITIAL INVESTIGATION OF HEAD-UP DISPLAY AT BLEU
J. C. Morrall 1968 22 p refs Submitted for publication Supersedes RAE-TR-66195; ARC-29660; See N68-12865
(ARC-CP-1001; RAE-TR-66195; ARC-29560) Copyright. Avail: CFSTI; HMSO 4s 6d

This paper aims to fulfil two main functions; firstly, it highlights what is believed to be the main safety problem in current bad weather landing and secondly, it presents results of initial flight trials with a head-up display which show that this aid has great potential value for category II operations. The safety problem is shown to lie in the limitations of the pilot in controlling the aircraft in pitch, using visual guidance. The head-up display is recommended as a solution to this problem as it can provide an efficient means of combining instrument and visual information. In addition, further improvements could be achieved by optimization of cockpit procedures, whether or not a head-up display is adopted. Author (ESRO)

N69-24274# Royal Aircraft Establishment, Farnborough (England).
PROPAGATION EFFECTS AND LANE AMBIGUITY RESOLUTION IN OMEGA
B. Burgess Jun. 1968 36 p refs
(RAE-TR-68151) Avail: CFSTI

Experimental data on VLF propagation taken during aircraft flights from the United Kingdom out over the North Atlantic have shown that under night conditions, waveguide mode interference is appreciable at distances at least as far as 7000 km from the transmitter, for frequencies between 10 and 14 kHz. The implications of these propagation results on the lane resolution ability of the OMEGA VLF navigational aid is discussed. Author (ESRO)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N69-23450*# United Aircraft Corp., East Hartford, Conn.
INITIAL RADIO-FREQUENCY GAS HEATING EXPERIMENTS TO SIMULATE THE THERMAL ENVIRONMENT IN A NUCLEAR LIGHT BULB REACTOR
John S. Kendall, Ward C. Roman, and Paul G. Vogt Washington NASA Apr. 1969 105 p refs
(Contract NASw-847)
(NASA-CR-1311; G-910091-17) Avail: CFSTI CSCL 18K

Initial experiments were conducted to develop an intense radiant energy source which would eventually be capable of producing radiant energy fluxes equal to those expected in a full scale nuclear light bulb engine. The test program was conducted using the UARL 1.2- megw r-f induction heater at dc input power levels up to approximately 250 kw to supply energy to the simulated fuel containment region of a vortex. The primary objective of the experimental program was to determine the effect of various parameters on the power radiated from the vortex, the power deposited in the peripheral wall of the vortex tube, and the power carried away by convection from the vortex. Both argon discharges with no seed and argon discharges seeded with submicron carbon and tungsten particles were employed. Tests were conducted at discharge pressures up to 6.0 atm abs and with up to 85 kw of power deposited in the discharge; of this, 35 kw was radiated through a water cooled transparent wall surrounding the discharge. The 35 kw of radiant energy represents a radiant energy flux of about 12.0 kw/in.^{2} (1.86 kw/cm^2), which corresponds to an equivalent black body radiating temperature of 7600 R. Author

N69-23452# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
FISSION DAMAGE IN SOLID FUELS, MAINLY URANIUM DIOXIDE: A CRITICAL SURVEY. PART 1: ATOMIC AND STATISTICAL DAMAGE MECHANISMS
Renato Bobone Jun. 1968 122 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6919) Avail: CFSTI

Complex problems of engineering behavior and of design of solid nuclear fuels arise because of in-pile radiation damage. The mechanical behavior of a solid fuel, in particular UO_2, is determined by the way in which a very large number of fission events affects its lattice structure under given operating conditions of neutron flux, temperature, and external pressure. Most damage is caused by the two or occasionally three fragments generated by each fission event. The fate of two fission fragments is followed from the instant of fission to their coming to rest in the lattice of the solid. These fragments, which are highly ionized as well as highly energetic at the beginning of their flights, at first lose energy mostly by ionized lattice atoms and then, as they become neutral atoms, by colliding with the atomic nuclei of the lattice. Author (NSA)

N69-23453# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
FUELS FOR WATER REACTORS
J. L. Scott and S. C. Weaver Dec. 1968 25 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2357) Avail: CFSTI

Uranium dioxide (UO_2) is universally selected as fuel for water reactors because of its superior compatibility with stainless steel or Zircaloy cladding, excellent irradiation stability, low reactivity with water, and low fabrication costs compared with metallic fuels, carbides, or nitrides. Pellets are generally preferred although considerable attention has been given to vibratorily compacted fuel, particularly for recycle. Because of service requirements, tight specifications must be met on trace element levels and fuel density, and for pelletized fuels, the shape of the pellet and the presence of chips or laminations are important. The irradiation behavior of UO_2 is influenced markedly by its low thermal conductivity and vaporization behavior. Under normal operating conditions, the fuel may be divided into three temperature zones, each of which has its individual character regarding fission-gas release and fuel swelling. Author (NSA)

N69-23468# Argonne National Lab., Ill. Metallurgy Div.
THORIUM-URANIUM-PLUTONIUM ALLOYS AS POTENTIAL FAST POWER-REACTOR FUELS. PART 1: THORIUM-URANIUM-PLUTONIUM PHASE DIAGRAM
S. Blumenthal, J. E. Sanecki, and D. E. Busch Sep. 1968 60 p refs
(Contract W-31-109-ENG-38)
(ANL-7258) Avail: CFSTI

The ternary Th–U–Pu system was investigated by means of metallography, room- and high-temperature x-ray diffraction, dilatometry, electrical resistance measurements, and differential thermal analysis. The liquid miscibility gap is restricted to the Th–U side of the system. A eutectic trough connects the Th–U and Th–Pu sides of the diagram. The peritectic reaction $\alpha_{Th} + L \rightarrow C$ ($C = Pu_2Th_{1-x}$) of the Th–Pu binary at 615°C joins the eutectic trough in a ternary peritectic reaction $\alpha_{Th} + \epsilon_{Pu} + L \rightarrow C$ at 630°C. In the solid state, three 4-phase reactions occur involving α_{Th} and the phases on the uranium side of the U–Pu system: a class III reaction $\alpha_{Th} + \beta U \rightarrow \gamma U \rightarrow \eta$ at 714°C, a class III reaction $\alpha_{Th} + \beta U + \eta \rightarrow \zeta$ at 610°C, and a class II reaction $\alpha_{Th} + \beta U \rightarrow \alpha U + \zeta$ at 595°C. Over a wide range of compositions the ternary alloys are in equilibrium with α_{Th} and the phases of the binary U–Pu system. Author (NSA)

N69-23469# Argonne National Lab., Ill.
DESIGN AND ANALYSIS OF INSTRUMENTED SUBASSEMBLY SYSTEM FOR EBR-2
A. Smaardyk, C. J. Divona, R. H. Olp, and E. Hutter Jun. 1968 48 p refs
(Contract W-31-109-ENG-38)
(ANL-7423) Avail: CFSTI

The research, design, and development work for the construction of a prototype subassembly for the EBR-2 reactor is described. The subassembly configuration is identical to a standard control rod subassembly. NSA

N69-23481 State Univ. of Iowa, Iowa City.
SPATIALLY DEPENDENT FREQUENCY RESPONSE OF COUPLED CORE REACTORS
Ira Wilson Merritt, Jr. (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-14811

The purpose of this study was to evaluate the spatially dependent frequency response of a realistic model of a coupled-core nuclear reactor and to determine what reactor parameters are important in affecting the frequency response. A modal analysis method was used to synthesize the reactor response in a five-region–reflector, fuel, coupling region, fuel, reflector–coupled reactor of the Argonaut type. The reactor was described by a two-energy-group diffusion-theory model which allowed for transverse leakage in both energy groups but did not provide for fission or absorption in the fast group. It was found that the frequency response changed significantly for a fixed oscillator location as the detector was moved across the reactor. It was also found that a change in the coupling distance of 10 to 15 cm had a pronounced effect on the frequency response in the range of coupling distances from 20 to 60 cm. Dissert. Abstr.

N69-23511# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Oct. 1968
27 Nov. 1968 150 p refs
(Contract W-31-109-ENG-38)
(ANL-7513) Avail: CFSTI

Highlights of project activities are summarized for the month of October 1968. Fuel development programs for the LMFBR are described. Operations of the ZPR-3 Assembly 51 and series of Assembly 52 for LMFBR physics developments during October 1968 are described. ZPR-6 and ZPR-9 operations are also described. A review of ZPPR operations during October 1968 is presented. Operations for the EBR-2 are described. Nuclear safety studies, including TREAT operations, and chemical separation activities are discussed. NSA

N69-23512# Nuclear Materials and Equipment Corp., Apollo, Pa. Plutonium Lab.
IRRADIATION TESTING OF PLUTONIUM DIOXIDE/URANIUM DIOXIDE FUELS Quarterly Report, Oct.–Dec. 1967
Apr. 1968 13 p refs
(Contract AT(30-1)-3432)
(NUMEC-3432-41; QR-14) Avail: CFSTI

Three pellet type fuel elements were irradiated to a nominal burnup of 60,000 MWd/t in GETR. Fuel elements consist of 0.20 inch diameter centerless ground pellets clad in 19 mil wall type 316L stainless steel. As-loaded parameters of these fuels are tabulated. Calculated peak thermal rating of these fuels was 320 to 350 watts/cm with centerline temperatures of 2000 to 2100°C. Metallographic examination of the fuel containing 20 wt % PuO_2–UO_2 substoichiometric coprecipitated and stoichiometric mechanically blended fuels was completed. Metallography of the mechanically blended substoichiometric fuel was previously reported. Transverse sections of the fuel were mounted in copper-bakelite moulds, ground, polished and cathodic vacuum etched. Author (NSA)

N69-23562# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Sep. 1968
29 Oct. 1968 145 p refs
(Contract W-31-109-ENG-38)
(ANL-7500) Avail: CFSTI

Highlights of project activities are summarized for the month of September 1968. Fuel development programs for the LMFBR are described. Operations of the ZPR-3 for LMFBR physics developments during September 1968 are also described. Operations for the EBR-2 are presented. Nuclear safety studies, including TREAT operations, and chemical separation activities are discussed. NSA

N69-23589# Argonne National Lab., Ill.
PYROCHEMICAL SEPARATION OF PLUTONIUM FROM IRRADIATED FUELS [SEPARATION PYROCHIMIQUE DU PLUTONIUM DANS LES COMBUSTIBLES IRRADIES]
A. Avogadro and J. G. Wurm Dec. 1968 19 p refs Transl. into ENGLISH from the Rept. EUR/C-IS/1199/68
(ANL-Trans-702; EUR/C-IS-1199/68) Avail: CFSTI

A combined reprocessing system for recovery of plutonium from irradiated fuels is described. Extraction and pyrochemical concentration of plutonium is performed at the reactor site after a short cooling period. This is followed by a final plutonium refining in a special plant prior to refabrication of the fuel elements. Complete destruction of the fuel is carried out in a bath of oxidizing and alkaline fused salts composed primarily of nitrates or peroxides. Chlorination is carried out on the uranate–plutonate precipitate. Uranium is then separated in the oxide form. The final purification of plutonium is achieved following the uranium separation. NSA

N69-23615# Atomics International, Canoga Park, Calif.
DOPPLER AND RELATED MEASUREMENTS IN A SOFT FAST-REACTOR SPECTRUM
T. H. Springer, R. J. Tuttle, J. M. Otter, and R. K. Paschall [1967] 47 p refs
(Contract AT(04-3)-701)
(AI-AEC-12705) Avail: CFSTI

Results of investigations of the neutron energy spectrum, reactivity coefficient, and Doppler coefficient measurements in a soft spectrum fast reactor are given. Measurements on materials for the liquid metal fast breeder reactor (LMFBR) are discussed; experimental apparatus and techniques are described. Calculational techniques for determining core neutronic characteristics are discussed; calculated spectra are shown graphically. Calculated and measured values are compared. Measurement of absolute reactivity worths is described; data are tabulated. Reactivity effects caused by heating and sample expansion are evaluated. Measurements of temperature coefficient of reactivity are discussed; reactivity worth is shown as a function of temperature. NSA

N69-23628# Idaho Nuclear Corp., Idaho Falls.
THE EFFECT OF SILICON ON FABRICATION AND REPROCESSING OF ALUMINUM ALLOY REACTOR FUELS
Bernice E. Paige, George W. Gibson, and Kenneth L. Rohde Nov. 1968 96 p refs
(Contract AT(10-1)-1230)
(IV-1194) Avail: CFSTI

The effect of silicon on both the fabrication and reprocessing of aluminum–uranium fuel was studied. Rolled castings of alloys used in these studies contained 0, 22, and 31% uranium, a range of silicon contents from 0 to 11%, and the remainder aluminum. Alloys were typical of those found in fuel element plates according to radiographic and metallographic examination. The silicon present in the alloys in excess of one atom of silicon per atom of uranium was segregated as elemental silicon in the aluminum matrix according to both x-ray diffraction and electron beam microprobe analyses. Maximum softness, as indicated by minimum tensile strength, was obtained in alloys with silicon to uranium atom ratios near one, while there was a hardening of the alloy above a ratio of one. Author (NSA)

N69-23629# California Univ., Livermore. Lawrence Radiation Lab.
CONCEPT FOR A GAS BUFFERED ANNULAR HEATPIPE FUEL IRRADIATION CAPSULE
J. D. Lee and R. W. Werner 25 Jul. 1968 25 p refs
(Contract W-7405-ENG-48)
(UCRL-50510) Avail: CFSTI

A nuclear fuel irradiation capsule capable of handling large (≈300 W/cm^2) and varying fuel specimen heat fluxes while inherently maintaining nearly constant specimen temperature was conceived and two bench models successfully tested using potassium and sodium as the working fluids. Test temperatures were in the 700°C range and heat source temperatures were preserved within ±15°C while undergoing factors of three changes in power. Author (NSA)

N69-23639# Israel Atomic Energy Commission, Tel Aviv.
ERROR ESTIMATION FOR CRITICALITY AND REACTIVITY COEFFICIENTS CALCULATIONS IN FAST REACTORS
L. Gitter and S. Yiftah Feb. 1968 27 p refs
(IA-1156) Avail: AEC Depository Libraries

A second order perturbation method for the computation of reactivity is suggested as well as a method for the computation of a number of parameters for the estimation of the errors involved. Several computations of Doppler and Na-void effects are performed in order to test the efficiency of the methods. The results are given in tabular form. Author (NSA)

N69-23679# United Kingdom Atomic Energy Authority, Dounreay (Scotland). Reactor Group.
ANALYTICAL ASPECTS OF CHEMICAL STUDIES ON IRRADIATED OXIDE NUCLEAR FUELS
V. M. Sinclair 6 Aug. 1968 23 p refs
(TRG-1735) Avail: CFSTI; UK 5s

Methods used for sampling and handling the fuels are discussed. The measurement of burnup by determination of radioactive and stable fission products is described, and possible errors in measurements for the Dounreay Fast Reactor are considered. Problems encountered in the determination of burnup from isotopic composition changes are also outlined. Work on the chemical nature of the fission products involved measurement of the oxygen potential of the irradiated fuel and identification of fission product inclusions. NSA

N69-23682# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
URANIUM AND OXYGEN SELF-DIFFUSION IN UO_2
J. F. Marin and P. Contamin 1968 36 p refs Presented at Fundamental Properties of Mater. and Nucl. Fuel Assemblies, Schnectady, N. Y., 22 Aug. 1968
(CEA-CONF-1054; MET-16/68; CONF-680825-2) Avail: AEC Depository Libraries

Uranium self-diffusion coefficients in hyperstoichiometric uranium dioxide UO_{2+x} ($0.005 \leq \chi \leq 0.217$) were determined in the temperature range 1275° to 1650°C by means of the alpha spectrum degradation method. The results can be fitted, in the composition range $0.03 < \chi < 0.20$, with the Arrhenius equation: $D = 0.13\ \chi^2\ [1 + 10^3\chi^3]\ \exp(-85{,}000/RT)$. Oxygen self-diffusion in massive UO_2 samples has been studied by means of mass spectrometry spark or laser source analysis, $^{18}O(p,\alpha)^{15}N$ reaction and ionic mass analyzer. In the temperature range 780° to 1250°C oxygen diffusion in stoichiometric samples can be represented by the equation: $D = 0.28\ \exp(-59{,}300/RT)$. A considerable enhancement of D with small stoichiometry deviations has been evidenced at 800°C. Author (NSA)

N69-23682# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
PILOT-SCALE EQUIPMENT DEVELOPMENT FOR PYROLYTIC-CARBON COATING
R. B. Pratt, J. D. Sease, and A. L. Lotts Dec. 1968 108 p refs
(Contract W-7405-ENG-26)
(ORNL-4302) Avail: CFSTI

Attainment of low power costs from high-temperature gas-cooled reactors using thorium-uranium-233 cycle depends on the successful development of fuel recycle technology, particularly for coated-particle fuels. A design of a 6-in.-dia coating furnace in which pyrolytic-carbon coatings have been deposited on sol-gel nuclear fuel particles in quantities to 10 kg per day is given. Equipment and processing requirements for future fabrication of ^{233}U-bearing fuels in the Thorium–Uranium Recycle Facility are defined. Primary emphasis is on the particle coating furnace and its operation with supplementary discussion of facilities, processes, and auxiliary equipment. Author

N69-23751# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
ANALOGUE STUDIES OF POWER TRANSIENTS FOLLOWING LOSS OF A SINGLE COARSE CONTROL ARM BLADE IN THE MATERIALS TESTING (DIDO-TYPE) REACTOR HIFAR
E. R. Corran and D. B. Mc Culloch Sep. 1968 50 p refs
(AAEC/TM479) Avail: CFSTI

Power transients resulting from the loss of a single coarse control arm blade in a materials testing reactor were studied. A point reactor model without reactivity feedback was assumed, and parameters covering a wide range of core conditions were studied. Operating limitations for avoidance of core damage in such an accident are suggested on the basis of some assumed safety criteria. Author

N69-23754# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ANALYSIS OF OPERATION OF A THYRATRON TRIGGER WITH NONLINEAR ASYMMETRICAL LOADING [ANALIZ RABOTY TIRATRONNOGO TRIGGERA S NELINEINOI NESIMMETRICHNOI NAGRUZKOI]
I. B. Enchevich and T. N. Tomilina 1968 44 p In RUSSIAN
(JINR-P9-3675) Avail: CFSTI

The schemes of thyratron triggers with nonlinear asymmetrical loading are analyzed. The criteria of a stable operation of such triggers are given, and a method for calculation of a loaded trigger scheme is suggested, taking into account the effect of the reverse conductance of thyratrons. Author (NSA)

N69-23755# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
ENGINEERING AND TEST BRANCH Quarterly Technical Report, 1 Apr.–30 Jun. 1968
K. A. Dietz, ed. Oct. 1968 78 p refs
(Contract AT(10-1)-205)
(IDO-17265) Avail: CFSTI

A sensitivity analysis was performed on the LOFT reactor fuel to determine the reactivity effects associated with the variations of fuel pin characteristics allowed in the fuel specifications. The effects of blowdown core cooling and initial heatup on reactor containment systems and fuel elements were studied. The pressure-temperature response of the containment systems and the temperature response of the fuel elements were also investigated. The CONTEMPT-PS digital computer code for predicting pressure-temperature transients within a pressure-suppression containment vessel during coolant loss accidents is described. Thermal symmetry was used to simulate post-blowdown heatup temperature transients in the LOFT core, and a heat transfer analysis was performed. The BURST computer program was expanded to two dimensions for analysis of hydraulic systems involving the branching and merging of flow paths. P.A.B.

N69-23768# General Electric Co., Pleasanton, Calif.
SIMCON: A DIGITAL COMPUTER PROGRAM FOR COMPUTING THERMIONIC CONVERTER PERFORMANCE CHARACTERISTICS
D. R. Wilkins 1 Feb. 1968 82 p refs
(Contract AT(04-3)-189)
(GESR-2109) Avail: CFSTI

The theoretical foundation and use of a digital computer program (SIMCON) for computing thermionic converter performance characteristics are described. The analyses and program simultaneously account for the influence of surface phenomena, volume phenomena, and Schottky effects on converter operation and yield output current characteristics which are in good agreement with experimental data for a very broad range of converter operating conditions. NSA

N69-23774# Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.
POSTIRRADIATION EXAMINATION OF THORIA-URANIA FUEL RODS Quarterly Progress Report, Jun.–Aug. 1968
W. N. Bishop, C. J. Baroch, V. D. Arthur, J. W. Ewing, J. E. Hamilton et al Dec. 1968 28 p refs
(Contract AT(30-1)-3809)
(BAW-3809-5; QPR-5) Avail: CFSTI

Mass spectrometric determinations of the isotopic compositions of uranium and plutonium have been completed. Data for the peak burnup zone of several rods are compared with the calculated abundances. Profilometer measurements of the fuel cladding, metallographic examinations of the fuel and the cladding, and preparation of the tensile specimens were completed. Tensile testing of the unirradiated stainless steel specimens was completed. Author (NSA)

N69-23796# Brookhaven National Lab., Upton, N. Y.
FISSION PRODUCT VAPORIZATION FROM SODIUM SYSTEMS
A. W. Castleman, Jr., and I. N. Tang Nov. 1968 28 p refs
Presented at Intern. Conf. on Sodium Tech. and Large Fast Reactor Design, Argonne, Ill., 7–9 Nov. 1968 Supported by AEC
(BNL-13099; Conf-681106-5) Avail: CFSTI

Results of analytical and experimental studies of the thermodynamic properties and transport behavior of fission products in Na are presented. Thermochemical properties required in the design of coolant stream cleanup systems employed during reactor operation are examined. The transport properties are considered together with the limiting case of maximum release. Fission product partial pressures above that of Na and their relative extent of vaporization are discussed. NSA

N69-23799# United Kingdom Atomic Energy Authority, Risley (England). Authority Health and Safety Branch.
THE CALCULATION OF RELIABILITY OF SYSTEMS THE PROGRAM NOTED
E. R. Woodcock 1968 78 p
(AHSB(S)-R-153) Avail: CFSTI

There are many circumstances in which it would be useful to know the probability, as a function of time, that a device or system will perform in the desired manner when called upon to do so and how long it is likely to take to act. The systems can vary in complexity from a simple burglar alarm to a complete automatic protective system for a nuclear reactor, from a small electronic amplifier to a large electrical supply network with a prescribed maintenance schedule, and in numerous other fields. Practically all of these systems may be reduced to a logical flow network which is often of large size. The methods of analysis of logical flow networks are discussed. A versatile computer program that has been developed to deal with networks too large to be tackled by other methods is described. The solution of a sample problem is also described in detail in an appendix. Author (NSA)

N69-23807# Bhabha Atomic Research Centre, Bombay (India). Reactor Engineering Div.
INTEGRATION OF THE POINT-REACTOR KINETIC EQUATIONS WITH A PERIODIC REACTIVITY INPUT BY USE OF QUASI-PERIODIC VECTOR SOLUTIONS
M. S. Trasi 1968 11 p refs
(BARC-371) Avail: CFSTI

It is shown that the complete reactor response to a periodic reactivity input can be obtained by studying the response over an

interval of time whose length is equal to (m+1) times the period of the input reactivity. M is the number of delayed neutron groups, and it makes use of the properties of linearly independent, quasi-periodic, vector solutions of the kinetic equations with periodic coefficients. These vector solutions exist subject to certain conditions which are generally satisfied. As an example, this method is applied to the case where the delayed neutrons are represented by a single group, and a sinusoidal reactivity is fed in. Author

N69-23808# Bhabha Atomic Research Centre, Bombay (India).
TRILAURYLAMINE AS AN EXTRACTING AGENT FOR THE FINAL PURIFICATION OF PLUTONIUM DURING THE REPROCESSING OF IRRADIATED FUEL
N. Srinivasan, M. V. Ramaniah, C. L. Rao, P. K. Khopkar, G. M. Nair et al 1968 33 p refs
(BARC-374) Avail: CFSTI

The results show no major deviations from the published work. Optimum conditions for the extraction and different stripping conditions are suggested depending upon the end processing of plutonium. It was found that plutonium 4 can be extracted with a high distribution coefficient (≈300) from 2M HNO_3 by 20% (v/v) solution of TLA in xylene. Under these conditions the decontamination of plutonium from uranium is expected to be the best. An organic loading of nearly 27 mg/ml of plutonium was obtained and no third phase formation was noticed even at the maximum loading conditions. Presence of large quantities of uranium in the aqueous phase was found to result in a considerable decrease in the distribution coefficients for plutonium. However, most of the uranium coextracted to the organic phase was found to be easily removed by scrubbing with 0.5 M HNO_3 once. The backwashing of plutonium from the organic phase was found to be possible with 2M acetic acid or with 1M H_2SO_4. Author

N69-23889# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
NUCLEAR SAFETY BRANCH OF USAEC DIVISION OF REACTOR DEVELOPMENT AND TECHNOLOGY Quarterly Report, Aug.–Oct. 1968
Dec. 1968 132 p refs
(Contract AT(45-1)-1830)
(BNWL-926) Avail: CFSTI

Continuing efforts in nuclear safety-related studies are reported. Two large scale experiments on the effectiveness of containment spray systems for reducing airborne fission product concentration were performed. Analog programs were designed to solve boundary layer equations for mass transport to surfaces by condensing steam. Acoustic emission techniques were developed for detecting cracks in pressure piping. Studies on the fixation of radioactive residues emphasized spray solidification and solidified waste products, and their evaluation. The plane strain fracture toughness was determined for ASTM A 533 B pressure vessel steel between −160° and −80°C in order to assess irradiation damage. N.E.N.

N69-23877# General Electric Co., Sunnyvale, Calif. Advanced Products Operation.
SODIUM-COOLED REACTORS FAST CERAMIC REACTOR DEVELOPMENT PROGRAM Quarterly Report, Nov. 1967–Jan. 1968
Mar. 1968 112 p refs
(Contract AT(04-3)-189)
(GEAP-5584; QR-25) Avail: CFSTI

An analysis is presented of the fuel element irradiation of plutonium and uranium oxide in a fast ceramic reactor. A gamma scan analysis was made of the burnup of plutonium and uranium oxides. Electron microscopy and radiographic analysis were used to determine the radiation effects upon the fuels. Measurements were made of the effects of fast neutrons on the mechanical properties of stainless steel-clad oxide fuels. B.G.D.

N69-23878# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
REACTOR PRIMARY COOLANT SYSTEM RUPTURE STUDY Quarterly Progress Report, Oct.–Dec. 1967
Mar. 1968 137 p refs
(Contract AT(04-3)-189)
(GEAP-5587; QPR-11) Avail: CFSTI

An analysis is presented of the probabilities and mechanisms of crack failures in carbon steel, low alloy steel, and stainless steel pipes in reactor coolant systems. Destructive tests and failure stress measurements were made at high temperatures. A computer program was developed for crack growth rate calculations from experimental circumferential crack growth measurements. B.G.D.

N69-23922# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
SAXTON PLUTONIUM PROGRAM Semiannual Progress Report, Period Ending 31 Dec. 1967
Mar. 1968 31 p refs
(Contract AT(30-1)-3385)
(WCAP-3385-14; EURAEC-1955) Avail: CFSTI

Burnup data on the PuO_2–UO_2 partial core of the Saxton reactor are presented. After 850 equivalent full power hours the average burnup was calculated to be 13,000 MWD/MTM with peak burnup calculated to be 24,075 MWD/MTM. Predicted fuel burnup and isotopic compositions of four low burnup rods are compared to those determined using the chemical and spectrometric data. The fission gas release calculations are compared to the experimental results. Author (NSA)

N69-23945# United Nuclear Corp., Elmsford, N. Y. Research and Engineering Center.
PERFORMANCE EVALUATION OF HEAT EXCHANGERS FOR SODIUM-COOLED REACTORS Quarterly Technical Progress Report, 1 Apr.–30 Jun. 1968
S. L. Israel, D. J. Nolan, and F. B. Malmborg 20 Jul. 1968 31 p
(Contract AT(11-1)-1452)
(UNC-5221) Avail: CFSTI

Methods for predicting stresses due to thermal transients are reviewed. The expected largest rates of temperature change are calculated for typical strain gage locations. The effect of these rates on strain gage response is estimated. The rates are sufficiently low to permit the use of steady-state calibration data in interpreting strain gage output during transients. Recommendations are made to improve the accuracy of pressure drop measurements. Several strain gage locations were changed because of interference with equipment supports. Rosette configurations at each location and procedures for eliminating calibration shifts resulting from transfer of gages from calibration test bars to the heat exchangers are under review. Author (NSA)

N69-23953# Atomics International, Canoga Park, Calif. Liquid Metal Engineering Center.
LIQUID METAL ENGINEERING CENTER (LMEC) Quarterly Technical Progress Report, Oct.–Dec. 1967
1 Sep. 1968 159 p
(Contract AT(04-3)-700)
(LMEC-68-1) Avail: CFSTI

The Liquid Metal Engineering Center performs numerous tasks in support of the LMFBR program such as: preparing engineering specifications and providing consulting services; maintaining a liquid metals information center; and operating a sodium component testing facility for evaluating the pumps, piping, heat exchangers, bearings, seals, instruments, and materials used. Progress in each of these programs is described. NSA

N69-24085*# Humphreys Corp., Concord, N. H. TAFA Div.
INDUCTION PLASMA HEATING: HIGH POWER, LOW FREQUENCY OPERATION AND PURE HYDROGEN HEATING
M. L. Thorpe and L. W. Scammon Washington NASA May 1969 59 p refs
(Contract NAS3-9375)
(NASA-CR-1343) Avail: CFSTI CSCL 20I

Induction plasma heating systems were developed and tested to powers up to 1000 kW. Operation on diatomic gases such as air at frequencies as low as 220 KHz was achieved with continuous operation at exit gas enthalpies over 40,000 Btu/lb. Pure hydrogen heating was demonstrated at 4 MHz and 100 kW producing exit gas enthalpies over one million Btu/lb. High power sheath mode operation was also achieved. Author

N69-24072# Reactor Centrum Nederland, Petten.
THE NERO DEVELOPMENT PROGRAMME. VOLUME 1: DESCRIPTION Final Report
P. C. van den Berg, J. W. H. van den Bergh, M. Bogaardt, C. de Bruin, R. J. Heyboer et al May 1968 531 p refs
(Contract EURATOM-007-61-6-PNIN)
(RCN-97-Vol-1) Avail: CFSTI

The history and scope of the NERO project, its basic specifications, the experimental programme, design development and future potential of the concept are preceding the main PWR design criteria. These include core physics, core thermal and hydraulic design; reactor coolant chemistry and reactor plant systems design; instrumentation, control and safety design criteria. A selection of main plant parameters and a plant design description are given. Radioactive waste disposal problems, the refueling procedure and analysis of hazards are also dealt with. ESRO

N69-24073# Reactor Centrum Nederland, Petten.
THE NERO DEVELOPMENT PROGRAMME. VOLUME 2: SYMBOLS AND DRAWINGS Final Report
P. C. van den Berg, J. W. H. van den Bergh, M. Bogaardt, C. de Bruin, R. J. Heyboer et al May 1968 267 p
(Contract EURATOM-007-61-6-PNIN)
(RCN-97-Vol-2) Avail: CFSTI

Symbols and drawings belonging to the design description of the PWR, contained in Volume 1, are presented. ESRO

N69-24083# Brookhaven National Lab., Upton, N. Y.
ESTIMATION OF IMPURITY LEVELS IN LMFBR FROM SOLUBILITY DATA, AND COMPARISON WITH IMPURITY BEHAVIOR IN LOOPS
J. R. Weeks [1968] 11 p refs Presented at Conf. on Sodium Technol. and Large Fast Reactor Design, Argonne, Ill.
(BNL-13172; CONF-681106-8) Avail: CFSTI

The types of impurities that might be found in an LMFBR are described. The lack of available data on their binary solubilities compounded with numerous probable or possible interactions between solutes in Na makes impossible the estimation of impurity levels in LMFBR Na from solubility data. The behavior of corrosion products in corrosion loops and of fission products in DFR is cited; at the present time, this information is believed to be more useful than the available solubility data in estimating LMFBR impurity levels. Author (NSA)

N69-24085# Atomics International, Canoga Park, Calif. Liquid Metal Engineering Center.
LIQUID METAL ENGINEERING CENTER (LMEC) Quarterly Technical Progress Report, Jan.–Mar. 1968
1 Oct. 1968 156 p
(Contract AT(04-3)-700)
(LMEC-68-13) Avail: CFSTI

The Liquid Metal Engineering Center performs numerous tasks in support of the LMFBR program such as: preparing engineering specifications and providing consulting services; maintaining a liquid metals information center; and operating a sodium component testing facility for evaluating the pumps, piping, heat exchangers, bearings, seals, instruments, and materials used. Progress in each of these programs is described. NSA

N69-24087# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
STOCHASTIC KINETIC THEORY FOR A SPACE- AND ENERGY-DEPENDENT ZERO POWER NUCLEAR REACTOR MODEL
Weston M. Stacey, Jr. 13 Aug. 1968 31 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6945) Avail: CFSTI

A stochastic kinetic theory for space and energy dependent, zero power, nuclear reactor models is constructed from a first collision probability argument. The space and energy domains are partitioned into discrete cells. Equations are developed for the probabilities for transitions among the possible states of the reactor, and an equation is obtained for the probability generating function for these transition probabilities. Equations for the mean values, variances, covariances, and correlation functions of the neutron and precursor distributions are derived. The stochastic distributions of neutrons and precursors are found to be space and energy dependent in subcritical reactors, but to attain a space and energy independent asymptotic form in supercritical reactors. The asymptotic distribution in a supercritical reactor is identical for the neutron and precursor distributions, and depends upon the manner in which the reactor is made supercritical. A method for applying the theory to low source startup calculations is suggested. Author (NSA)

N69-24090# Gulf General Atomic, Inc., San Diego, Calif.
REACTOR REQUIREMENTS FOR FIRST GENERATION THERMIONIC NUCLEAR ELECTRIC PROPULSION
J. F. Ingber and D. T. Higdon 1 Nov. 1968 33 p
(Contract AT(04-3)-167)
(GA-9048) Avail: CFSTI

The lifetime and reactor power level requirements for first generation unmanned nuclear electric propulsion systems are investigated. A Titan III F/Centaur launch vehicle coupled with a 50

to 100 kW(e) thermionic nuclear electric propulsion system was selected as a representative configuration for planetary missions. Relevant mission-related technology constraints are considered in detail, and the performance capabilities of such a system are described. NSA

N69-24092# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SURVEY OF REACTOR FACILITIES FOR PRESSURE TUBE IRRADIATION
P. A. Ard, E. N. Heck, and C. H. McJilton Nov. 1968 48 p
(Contract AT(45-1)-1830)
(BNWL-872) Avail: CFSTI

A review of available reactor facilities for fast neutron irradiation studies of Zircaloy 2 and Nb–Zr pressure tubes is presented. The reactor facilities described include loops of ETR and ATR. NSA

N69-24115# Argonne National Lab., Ill.
IRRADIATION BEHAVIOR OF HIGH-BURNUP URANIUM-PLUTONIUM ALLOY PROTOTYPE FUEL ELEMENTS
W. N. Beck, R. J. Fousek, and J. H. Kittel May 1968 47 p refs
(Contract W-31-109-ENG-38)
(ANL-7388) Avail: CFSTI

Alloys containing both uranium and plutonium are being developed as fuels for fast breeder reactors. The alloys selected for the study described were U–Pu–Fs, U–Pu–Zr, and U–Pu–Ti. The irradiation behavior of the U–20 wt % Pu–10 wt % Fs alloy has been evaluated previously in the form of prototype EBR-II fuel elements. Additional work on this alloy and results obtained from studies on more advanced fuel alloys are reported. The irradiation studies were performed with cylindrical fuel pins sodium-bonded to tubular cladding. The cladding materials investigated included refractory alloys as well as iron- and nickel-base alloys. The investigations studied variations in the (1) plutonium concentration in the fuel pin, (2) cladding wall thickness, (3) irradiation temperature, (4) vented plenums, (5) type of cladding materials, and (6) type of fuel materials (solid fuel, disc-type fuel, and sodium-impregnated powder fuel). Author (NSA)

N69-24116# Kernforschungszentrum, Karlsruhe (West Germany).
HIGH TEMPERATURE GAS COOLING FOR FAST BREEDERS
M. Dalle Donne, E. Eisemann, F. Thuemmler, and K. Wirtz Oct. 1968 18 p refs Presented at the Symp. on Advan. and High Temp. Gas-Cooled Reactors, Juelich, Germany
(KFK-841; SM-111/12; EURFNR-580; EUR-3978; CONF-681008-3) Avail: AEC Depository Libraries

The development of a reliable and satisfying fuel element is analyzed. Three possibilities for high temperature fuel design include: $(U,Pu)O_2$ or (U,Pu)C fuel in a vanadium alloy cladding; cermets with $(U,Pu)O_2$ particles in a chromium matrix; and ceramic coated particles. All three fuels would allow relatively high gas outlet temperatures above 720°C, which allow the use of a direct gas turbine cycle with a net plant efficiency above 40%. Nuclear calculations for 1000 MW(e) cores have been performed in order to examine the nuclear potential of these different types of fuel. In all cases the coolant pressure is considerably higher than the pressure normally used in thermal gas-cooled reactors. The special safety aspects that appear in connection with gas-cooled fast reactors are briefly discussed. Author (NSA)

N69-24119# United Kingdom Atomic Energy Authority, Harwell (England).
AN EVALUATION OF TIME OF FLIGHT AND CONVENTIONAL DIFFRACTION TECHNIQUES AT HARWELL
D. H. Day and R. N. Sinclair Sep. 1968 12 p refs
(AERE-R-5896) Avail: CFSTI; UK 2s 6d

Time-of-flight and conventional continuous source techniques for thermal neutron scattering studies are compared. Experience in three fields of research (structure factor measurement, neutron inelastic scattering and the coherent scattering by liquids) gained in experiments on the pulsed source provided by the Harwell electron linac is used to compare the potentialities of the pulsed source method, with the techniques used at present on the DIDO reactor. The derived figures of merit indicate the power of the time-of-flight method and indicate that the Harwell electron linac can be developed into a pulsed thermal neutron source of comparable standing to the DIDO reactor as at present used, and that the application of pulsed source techniques to the DIDO reactor would give a further factor 20 improvement. Author (NSA)

N69-24123# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
LITERATURE SURVEY ON IN-PILE MECHANICAL PROPERTIES: TESTING AND THEORY
S. H. Miller, G. J. Moyar, and C. E. Troller 15 Aug. 1968 40 p refs
(Contract W-31-109-ENG-52)
(KAPL-3453) Avail: CFSTI

A survey of unclassified literature published from 1962 to 1968 on the in-pile mechanical properties of reactor structural and fuel materials was conducted. Information on test equipment, experimental results, and theory were considered. The current review includes a state of the art summary of in-reactor Zircaloy properties, a tabular summary of information given in the cited literature, and a listing of the cited references with abstracts. Author (NSA)

N69-24130# Oak Ridge National Lab., Tenn.
HIGH FLUX ISOTOPE REACTOR Quarterly Report, Jul.–Sep. 1968
R. V. Mc Cord and B. L. Corbett Sep. 1968 32 p refs
(ORNL-TM-2437) Avail: CFSTI

Operations during July to September 1968 are described. A description of the shutdowns during the quarter is presented. Progress on the control-plate-bearing problem is described. Maintenance requirements are listed. Exhaust filters are rated for efficiency. Water condition monitorings are also listed. Design changes are described. NSA

N69-24143# Bettis Atomic Power Lab., West Mifflin, Pa.
SHIPPINGPORT PWR CORE 2 SEED 1 PHYSICS TEST RESULTS FROM BEGINNING-OF-LIFE TO MID-LIFE TEST EVALUATION
F. E. Smith Sep. 1968 77 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-PWR-TE-205) Avail: CFSTI

The results of physics tests conducted during the first half of PWR Core 2 Seed 1 lifetime are presented. The period of these tests covers operations from initial criticality in February 1965 to the completion of about 5900 equivalent full power hours in October 1966. These tests have provided information on critical rod positions and reactivity worths, temperature coefficients, xenon transient characteristics, core reactivity symmetry, and reactivity loss rates. Calculated characteristics of the core were found in general to be in good agreement with the measured nuclear characteristics. Author (NSA)

N69-24147# Atomics International, Canoga Park, Calif.
LARGE RADIOISOTOPE HEAT SOURCE CAPSULE (LRHSC) Quarterly Progress Report, 1 Jul.–30 Sep. 1968
15 Nov. 1968 51 p refs
(Contract AT(29-2)-2338)
(AI-AEC-12753; QPR-5) Avail: CFSTI

Progress is reported on the development of a large radioisotope heat source capsule capable of operating in a space environment at a surface temperature of about 2000°F for five years or more. The objectives of the program are to design, fabricate, test, and evaluate a test capsule whose design takes into account the operating requirements of a typical heat source. Progress is reviewed in the following tasks: program management; capsule design; process development; fabrication and assembly; creep testing; and impact testing. NSA

N69-24150# Union Carbide Corp., Oak Ridge Tenn. Gaseous Diffusion Plant.
APPLICATION OF THE PERIPHERAL COMPRESSOR TO THE FLUORIDE VOLATILITY PROCESS
M. J. Stephenson, L. W. Anderson, and P. S. Cates 17 Jan. 1969 59 p refs
(Contract W-7405-ENG-26)
(K-1751) Avail: CFSTI

To lower operating costs in reprocessing plants by reducing reagent usage, gas recycle was proposed for use in the fluorination and hydrochlorination steps of the fluoride volatility process for the recovery of valuable uranium and plutonium from spent nuclear reactor fuels. A detailed description is presented of the development and testing of a prototype two-stage peripheral compressor designed for recycle service. An account is given of the maintenance requirements and operating problems encountered in over 2 years of intensive testing, including 6,200 hours of operation using mixtures of nitrogen, fluorine, and uranium hexafluoride. The overall performance and acceptability of the compressor, as it might be used in a 1-ton of uranium per day reprocessing plant, were critically evaluated and found to exceed design criteria. Author (NSA)

N69-24171# McDonnell-Douglas Co., Richland, Wash. Donald W. Douglas Labs.
APPLICATION OF THE RADIOISOTOPE-FUELED STIRLING ENGINE TO CIRCULATORY SUPPORT SYSTEMS Final Report
R. B. Goranson Jun. 1968 229 p refs
(Contract AT(45-1)-2112)
(TID-24699) Avail: CFSTI

A design and analysis study to develop a conceptual design of a radioisotope-powered thermodynamic engine to serve as the power source in an implantable circulatory support system is presented. The study establishes the technical feasibility of a Stirling cycle engine using radioisotope fuel. Thermodynamic operating principles are given, and design and operating details of the power source are described. Shielding requirements and radiation level at the power source surfaces are presented parametrically. Author (NSA)

N69-24204# Scientific Translation Service, Ann Arbor, Mich.
PREPARATION OF URANIUM INGOTS FROM DOUBLE FLUORIDES
Emile Le Boulbin May 1967 40 p refs Transl. into ENGLISH from French Report CEA-R-3248 Sponsored by ORNL
(ORNL-TR-1828; CEA-R-3248) Avail: CFSTI

A simple method has been developed for the preparation of uranium double fluorides and has given a new impetus to the study of the reduction of these compounds with a view to obtaining very pure uranium ingots. Reduction can be carried out using calcium or magnesium as the reducing agent, this latter metal being very interesting from the practical point of view. A comparative study of the heat balances of the reduction processes for the double fluorides and for uranium tetrafluoride has shown that reduction of the double fluorides is possible. The exact experimental conditions for these reductions have been determined. It was found that the reduction of the double salt UF_4, CaF_2 by magnesium leads to the production of small (20 to 500 g) samples of high-purity uranium with a yield of 99 percent. Author (NSA)

N69-24209# Weiner Associates, Inc., Baltimore, Md.
A COLLATION AND EVALUATION OF ANALYSES AND EXPERIMENTS ON THE RE-ENTRY BEHAVIOR OF PuO_2 MICROSPHERES
David W. Pyatt and Peter P. Ostrowski Aug. 1968 114 p refs
(Contract AT(29-2)-2518)
(WAI-TR-68.2) Avail: CFSTI

A state-of-the-art survey was established. It was found that the theories for the prediction of breakup or instability for both fully and semi-molten microspheres are too approximate to be used. The most useful data for correlation breakup are shock tunnel experiments on zirconium and Fe_2O_3 particles and, to lesser extent, arc tunnel experiments on $^{238}PuO_2$ in microspheres. The experimental results cannot be directly applied to real atmospheric release conditions. Melting initiation can be predicted in release coordinates. Once melting begins, the fluid dynamic behavior of the molten PuO_2 and its effects on the heat transfer is not known. Significant deformation results from deceleration forces. The only experiments where deceleration forces were included are the shock tunnels experiments. Based on the arc tunnel experiments, two criteria for mass loss were observed: non-breakup mass loss attributed to vaporization, boiling of impurities, or trapped helium blowout and breakup and/or stripping. Author (NSA)

N69-24217# Bettis Atomic Power Lab., Pittsburgh, Pa.
FISSION GAS BUBBLES IN FRACTURED UO_2 CHIPS
O. M. Katz May 1968 4 p refs Presented at the 26th Ann. Meeting of Electron Microscopy Soc. of Am., New Orleans, Sep. 1968
(Contract AT(11-1)-GEN-14)
(WAPD-T-2067; CONF-680905-4) Avail: CFSTI

The swelling of irradiated UO_2 is analyzed. The bubble characteristics observed by transmission electron microscopy in high density UO_2 irradiated between 3.8 and 24.9 $\times 10^{20}$ fissions/cm^3 at temperatures below 870°C are described. The size and distribution of the fission gas bubbles in chips were analyzed before and after in-microscope heating at 1200 to 1400°C for 5 minutes. NSA

N69-24378# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
SOME TECHNOLOGICAL PROBLEMS OF FAST NEUTRON REACTORS
M. S. Pinkhasik [1968] 6 p Transl. into ENGLISH from Vystupleniye V Diskus. Na Sekts. Sz UP Mirovey Energ. Konf. Presented at the 7th World Conf. on Power, Moscow, 20–24 Aug. 1968
(AEC-TR-6974) Avail: CFSTI

A survey of technological experience and problems with Na cooled fast breeder reactors is given. The use of large Na cooled fast reactors for power production is discussed; the economic incentives for this type of power reactor are considered. NSA

N69-24384# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
QUANTITATIVE ANALYSIS OF REACTOR SAFETY
L. M. Arnett Nov. 1968 55 p
(Contract AT(07-2)-1)
(DP-1168) Avail: CFSTI

The behavior of the safety mechanisms of a nuclear reactor is modeled, and the probabilities of each incident whose consequences are of safety concern are calculated by either of two computer programs. The model accounts for scheduled inspection and maintenance of all mechanical devices. Author (NSA)

N69-24433# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
MOATA TRANSFER FUNCTION
A. P. Marks Oct. 1968 17 p refs
(AAEC/TM-481) Avail: AEC Depository Libraries

The zero-power transfer function of the Argonaut-type reactor MOATA has been measured using a digital correlation technique. Analysis of the results yielded a value of 124 μs for the prompt neutron mean lifetime. Author (NSA)

N69-24437# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
USE OF ULTRASONICS FOR TESTING FOUNDARY BILLETS AND SEMI-FINISHED EXTRUSIONS IN ALLOYS OF THE Mg-Zr TYPE FOR CANNING [EMPLOI DES ULTRA-SONS POUR LE CONTROLE DES BILLETES DE FONDER I DEMI-PRODUITS EXTRUDES EN ALLIAGES DU TYPE Mg-Zr POUR GAINAGE]
M. T. Destribats, G. Lastiboudois, F. Papezyk, P. Richard, A. Trieule et al [1968] 17 p in FRENCH Presented at the Symp. on Nondestructive Testing and Control in the Field of Nucl. Met. and Technol., Saclay, France, 24 Jun. 1968
(CEA-Conf-1069; Conf-680606-8) Avail: AEC Depository Libraries

Ultrasonic frequencies are suitable for examining the quality of parts with a magnesium base, and a method for testing the manufacturing quality of cans for fuel elements of the natural uranium graphite/CO_2 system is examined. Inspection at the factory was carried out in the foundry on billets and then after extrusion on semi-finished products. Comparisons of the quality classifications at the two stages of inspection were made. An experiment was carried out on 24 billets of different qualities and 260 blanks produced from them were inspected. The influence of superficial defects on the quality classification of the blanks was studied. Conclusions were obtained about the practical value of the two types of inspection. Author (NSA)

N69-24464# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Neutronenphysik und Reaktortechnik.
THEORETICAL TREATMENT OF HYPOTHETICAL SEVERE ACCIDENTS ON FAST POWER REACTORS [THEORISCHE BEHANDLUNG HYPOTHETISCHER, SCHWERER UNFAELLE BEI SCHNELLEN LEISTUNGSREAKTOREN]
D. Braess and K. Thurnay Jul. 1968 25 p refs In GERMAN; ENGLISH summary
(KFK-813; EUR-3971.d) Avail: AEC Depository Libraries

In the design of fast power reactors the safety considerations are governed by the investigation of second excursions. These excursions might occur when there is an assumed failure of the cooling system and, at the same time, a breakdown of all safety devices. Second excursions are mostly studied with the so-called Bethe–Tait Method. This method is developed further and the effect of doppler feedback and of delayed neutrons is studied. Author (NSA)

N69-24485# Kernforschungszentrum, Karlsruhe (West Germany). Institute fuer Reaktorbauelemente.
FUEL ELEMENT WITH SPIRAL SPACER FOR FAST BREEDER REACTORS [BRENNELEMENTE MIT WENDELFOERMIGEN ABSTANDSHALTERN FUER SCHNELLE BRUTREAKTOREN]
W. Baumann, V. Casal, H. Hoffmann, R. Moeller, and K. Rust Apr. 1968 119 p refs In GERMAN
(KFK-768; EUR-3694.d) Avail: AEC Depository Libraries

The configuration and design of fast breeder reactor fuel elements with spiral spacers is discussed; design parameters are tabulated; fuel bundle cross sections are shown. Fabrication of the elements is discussed; tolerances are given; thermal expansion effects and allowances are considered. Heat transfer and pressure drop studies for the fuel element are detailed; surface and configuration effects are analyzed. Coolant mixing in the fuel element coolant channels is discussed. Temperature distributions are calculated for the cladding material. NSA

N69-24532# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
CALCULATIONS OF FUEL BURN-UP IN HEAVY-WATER REACTOR CONSIDERING CHANGES IN THERMAL AND EPITHERMAL NEUTRON SPECTRA [VYPOCET VYHORENI PALIVA V TEZKOVODNIM REAKTORU S UVAZENIM ZMENY SPEKTER TEPELNYCH A EPITERMALNICH NEUTRONU]
B. Kujal Jul. 1968 7 p refs In CZECH; ENGLISH summary
(UJV-2027) Avail: AEC Depository Libraries

The burnup calculations of the fuel in the outer zone of the A 2 reactor were performed with respect to the thermal and epithermal spectrum change. The influence of ^{239}Pu and ^{240}Pu isotopes accumulation on the spectrum in the lattice and the reactivity change was determined. The results (dependence of reactivity on burnup and fuel isotopic composition) were compared with those of FPV-1 program calculations based on Westcott's method of thermal cross sections. Author (NSA)

N69-24589# Panametrics, Inc., Waltham, Mass.
ULTRASONIC THERMOMETRY IN LMFBR SYSTEMS Quarterly Progress Report, 1 Apr.–30 Jun 1968
S. Fam, L. C. Lynnworth, and E. H. Carnevale Jun. 1968 14 p ref
(Contract AT(30-1)-3906)
(NYO-3906-3; QPR-3) Avail: CFSTI

The testing of an ultrasonic system to measure temperature in the coolant, cladding and fuel meat of liquid metal cooled fast breeder reactors (LMFBR's) is described. Sodium immersion tests were conducted up to 700°F. These tests: demonstrated lead-wire transmission through liquid Na, with ≈ 20 ft sections of lead-in wire both directly immersed in liquid Na and also contained in an immersed sheath; determined the feasibility of using the immersed fuel cladding as temperature sensor; determined the feasibility of using sheathed tungsten and/or SS 304 as lead-in wires; and demonstrated the structural integrity of the ultrasonic thermometer with respect to the liquid Na environment. Several types and sizes of commercially available wire were evaluated for the transducer coil. The most satisfactory compromise for a combined transmit/receive coil from the standpoints of reliability, voltage breakdown, signal amplitude and stability, was found in #40 Nichad wire. Author (NSA)

N69-24575# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
DESCRIPTION OF CSF-67 EDDY-CURRENT TESTING APPARATUS AND FIRST RESULTS [DESCRIPTION DE L'APPAREILLAGE DE CONTROLE PAR COURANTS DE FOUCAULT CSF-67: PREMIER RESULTATS]
M. Pigeon, M. T. Destribats, and B. Declee (Societe Leanord, Lille) [1968] 22 p refs In FRENCH; ENGLISH summary Presented at Symp. on Nondestructive Testing and Control in the Field of Nucl. Met. and Tech., Saclay, France, 24 June 1968
(CEA-Conf-1073; Conf-680606-10) Avail: AEC Depository Libraries

An eddy current testing apparatus, developed for examining reactor fuel cladding, is described, and the results obtained on several types of stainless steel, magnesium, and beryllium cladding are given. NSA

N69-24587# Puerto Rico Nuclear Center, Mayaguez.
A STUDY OF COMPUTATIONAL METHODS USED TO DETERMINE FUEL DEPLETION IN NUCLEAR REACTORS
Aviva E. Gilsadi and Cho-Fu Lee (M.S. Thesis—Puerto Rico Univ.) March 1968 257 p refs
(Contract AT(40-1)-1833)
(PRNC-117) Avail: CFSTI

The problem of fuel depletion is studied in uranium fueled, light water moderated, thermal reactors. The fitted cross section scheme is used to compute fast few-group constants. Depletion equations were derived for pure U-235 fuel, as well as for U-235 and U-238 mixtures. The assumption of constant power versus constant flux is discussed. An extensive survey of depletion codes is described. The codes are characterized by means of relevant data, including: reactor geometry option, number of regions, number of mesh points, number of energy groups, burnable poison option, type of computer for which the code has been written, programming language used, and running time for a typical problem. A Friden electric desk computer is used to compute depletion effects for two highly simplified models. A computer code BURNUP written in FORTRAN II is developed for the IBM 1620 computer; the code will calculate depletion effects for an enriched uranium fueled and light water moderated homogeneous reactor model, using the few-group scheme. Author (NSA)

N69-24606# Mound Lab., Miamisburg, Ohio.
SUBCRITICAL NEUTRON MULTIPLICATION EXPERIMENT WITH FOUR SNAP-19B (IRHS) HEAT SOURCES CONTAINING Pu 238
R. A. Wolfe and W. F. Stubbins 24 Jan. 1969 16 p
(Contract AT(33-1)-GEN-53)
(MLM-1523) Avail: CFSTI

Subcritical neutron multiplication experiments were performed with four SNAP-19B (IRHS) heat sources containing ^{238}Pu at different array spacings in both air and water. Each source contained approximately 1 kg of ^{238}Pu, the largest quantity of this isotope ever assembled in a controlled experiment. The maximum neutron multiplication of 1.19 was obtained with the four heat sources completely submerged in water in a 1/8-in. (0.3-cm) edge-to-edge planar array. Author (NSA)

N69-24608# Union Carbide Nuclear Co., Oak Ridge, Tenn. Gaseous Diffusion Plant.
DESIGN MODEL FOR THE DYNAMIC ADSORPTION OF URANIUM HEXAFLUORIDE ON FIXED BEDS OF SODIUM FLUORIDE
Michael J. Stephenson (M.S. Thesis—Tenn. Univ., Knoxville) Dec. 1968 78 p refs
(Contract W-7405-ENG-26)
(K-L-6195-2) Avail: CFSTI

A mathematical model was developed that describes the dynamic adsorption of uranium hexafluoride on fixed beds of sodium fluoride. This model is intended for the design engineer as a means of sizing sodium fluoride traps for use in uranium hexafluoride collection and purification. The analysis, which requires a digital computer program, is limited to isothermal, isobaric systems where the concentration of uranium hexafluoride in the feed gas is less than 10 mol %. Data obtained from reported experiments with the uranium hexafluoride–sodium fluoride system are compared with calculated results; the closeness of agreement establishes the reliability of the model within the range covered by available data. A discussion of general results is given, including the dependence of adsorber performance on pellet properties and other physical parameters as implied by the behavior of the model. Author (NSA)

N69-24610# Oak Ridge National Lab., Tenn. Chemical Technology Div.
TEMPERATURE PROFILES WITHIN CYLINDERS CONTAINING INTERNAL HEAT SOURCES AND MATERIALS OF TEMPERATURE-DEPENDENT THERMAL CONDUCTIVITIES: DESCRIPTION OF FAST COMPUTER PROGRAMS AS APPLIED TO SOLIDIFIED RADIOACTIVE WASTES
W. Davis Jr. Jan. 1969 32 p refs
(Contract W-7405-ENG-26)
(ORNL-4345) Avail: CFSTI

The safety and economic aspects of producing and storing radioactive wastes as solids, usually in vessels having a cylindrical geometry, require that we know the maximum internal temperatures to be expected as a result of decay heat. Such information is mandatory for materials that have variable thermal conductivities under different storage conditions. A computer program (STORE) is presented, which was written to permit more rapid calculation of temperature profiles within cylinders containing homogeneously distributed heat sources and materials whose thermal conductivities can be expressed as a tabular function of temperature. A simplified version of this program was prepared for the cases in which the thermal conductivity is constant or is a linear function of temperature. Both of these programs have short execution times, typically from a few to 20 seconds on the IBM/360-75 as compared with the five or more minutes required for the more accurate finite-difference method. Author (NSA)

N69-24612# Argonne National Lab., Ill.
LABORATORY INVESTIGATIONS IN SUPPORT OF FLUID-BED FLUORIDE VOLATILITY PROCESSES. PART 20: FISSION-PRODUCT TELLURIUM OFF-GAS DISPOSAL IN THE FLUID-BED FLUORIDE VOLATILITY PROCESS
D. R. Vissers and M. J. Steindler Aug. 1968 41 p refs
(Contract W-31-104-ENG-38)
(ANL-7464) Avail: CFSTI

The volatile fluoride species of fission product tellurium, tellurium hexafluoride, represents a troublesome component in the fluid bed, fluoride volatility process off-gas system. The problem results from the relatively high concentration of the highly toxic radioactive tellurium found in spent reactor fuels and the chemically inert character of tellurium hexafluoride found in the process off-gas system. Gas sorption with tellurium hexafluoride on various sorbents was studied, both in static and flowing type systems, to evaluate 13 sorbents as potential trapping agents for tellurium hexafluoride. Radio-tagged tellurium hexafluoride was used in the gas-flow studies. These studies revealed that activated alumina can

effectively remove tellurium hexafluoride from an off-gas stream containing fluorine. Tellurium hexafluoride removal efficiencies in excess of 99.995% were easily obtained. The heat of sorption for TeF_6 on activated alumina was found to be 4.8 kcal mole^{-1}. The TeF_6 sorptive ability of activated charcoal was also investigated. Author (NSA)

N69-24622# Johns-Manville Research Center, Manville, N. J.
DEVELOPMENT OF 400 TO 2200F FIBROUS-TYPE INSULATIONS FOR RADIOISOTOPE POWER SYSTEMS Quarterly Progress Report, 1 Oct. – 31 Dec., 1968
J. O. Collins, K. L. Jaunerajs, and D. R. Reid 2 Jan. 1969 31 p refs
(Contract AT(29-2)-2661)
(ALO-2661-11; QPR-8) Avail: CFSTI

The thermal conductivity study of the MIN-K Formulations developed under Phase I uncovered what may have been the cause of the earlier erratic data. If further testing confirms these findings, the Guarded Hot Plate test procedure for evaluating MIN-K at temperatures above 800°F mean may require significant alteration. Attempts to manufacture an opacified Glasrock product were concluded unsuccessfully. Additional load-bearing data were subsequently obtained for the unopacified product. Author (NSA)

N69-24623# Thermo Electron Corp., Waltham, Mass.
RESEARCH AND DEVELOPMENT OF VACUUM FOIL-TYPE INSULATION FOR RADIOISOTOPE POWER SYSTEMS Quarterly Progress Report, Sep.–Nov. 1968
J. Carvalho, J. B. Dunlay, J. Fronduto, M. L. Paquin, and V. L. Poirier 20 Jan. 1969 91 p
(Contract AT(30-1)-3634)
(ALO-3634-11; TE-4059-109-69) Avail: CFSTI

Progress is reported on the development of high temperature thermal insulation for radioisotope power systems. Additional data relating to the oxide coating density optimization studies have been obtained. The insulation samples for the reproducibility tests have been fabricated and the standard deviation of the oxide coating densities was only 5.6%. The initial series of uniform loading heat transfer tests has been completed and a sizeable heat flux increase was noted. Comparisons with planar data indicated that compressive stresses of 2 to 3 psi acted on the insulation. The concentric cup corner assembly was fabricated and evaluated in the edge heat loss test apparatus. The thermal losses varied between 0.1 watt/cm of edge at 900°C to approximately 1.0 watt/cm of edge at 1700°C. Additional Pt–ZrO_2, Al–ZrO_2, Cu–ZrO_2, and SS–ZrO_2 data are presented in the 200 to 700°C temperature range. Author (NSA)

N69-24628# United Kingdom Atomic Energy Authority, Springfields (England). Reactor Group.
THEORETICAL ANALYSIS OF SOME FORCES, STRESSES, AND STRAINS PRODUCED IN NUCLEAR FUEL ELEMENT CLADDING BY THERMAL EXPANSION OF CRACKED FUEL PELLETS
J. H. Gittus 23 Aug. 1967 24 p refs Reprinted
(TRG-Rept-1547; JNPC-FEWP-(67)-P.29; SGHWR-FEMWG-P.275 FRPC-FEWP-(67)-P.438) Avail: CFSTI

Some of the stress, force and strain distributions produced in collapsed cladding by the expansion of cracked pellets during a power increase have been calculated analytically. As the radial and transverse cracks in the pellet open, the tendency for the cladding to stretch preferentially over them is reduced by frictional sliding at the pellet/clad interface. The frictional forces opposing sliding are intensified by a high coolant pressure (which holds the can onto the fuel) while the ability of the cladding to resist the friction forces without being locally deformed depends on its strength. The coefficient of friction, cladding dimensions, number of radial pellet cracks, strain hardenability and temperature gradients around the cladding influence the tendency for cladding strain to be concentrated over the opening pellet cracks. Author (NSA)

N69-24635# Oak Ridge National Lab., Tenn.
OAK RIDGE RESEARCH REACTOR Quarterly Report, Jul.–Sep. 1968
W. H. Tabor and S. S. Hurt, III 20 Nov. 1968 46 p
(Contract W-7405-ENG-26)
(ORNL-TM-2458) Avail: CFSTI

Operating experience, instrument and process maintenance, and experiment activities during July to September 1968 are described. NSA

N69-24644# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EVALUATION OF SODIUM REMOVAL METHODS FOR FUEL ELEMENTS AND PIPING SYSTEMS
G. R. Bloom 4 Nov. 1968 23 p refs Presented at the Conf. on Sodium Technol. and Large Fast Reactor Design, Argonne, Ill.
(Contract AT(45-1)-1830)
(BNWL-SA-2198; Conf-681106-9) Avail: CFSTI

Effects of three sodium removal procedures and subsequent reinsertions into high temperature sodium were determined for 304 stainless steel material samples. Sodium removal procedures used were: mercury amalgamation, Dowanol EB reaction, and argon-steam reaction. Type 304 stainless steel material samples were single specimens, crevice specimens and simulated FFTF fuel pins. Sodium exposures were in isothermal, stagnant sodium capsules at 800, 1000, 1200, and 1400°F for 500 hr. Metallographic and microscopic examinations after one and two sodium exposures followed by sodium cleaning showed no intergranular attack on the fuel pin samples exposed to 1200°F sodium. Burst tests conducted on 1/4 in. dia fuel cladding samples at room temperature before sodium exposure, after one sodium exposure and one cleaning cycle, and after two sodium exposures, and two cleaning cycles showed no change in burst stress. Author (NSA)

N69-24658# Atomics International, Canoga Park, Calif.
A VARIATIONAL SYNTHESIS METHOD FOR CALCULATING STRUCTURE SHIELDING DATA Final Report
Bruce D. O'Reilley Jun. 1968 82 p refs
(Contract N00228-67-C-2317)
(AD-680457; AI-68-51; NRDL-TRC-68-50) Avail: CFSTI CSCL 18/6

A study was made to find and apply improved numerical methods for solving the gamma-ray transport problem in multidimensional structures. It appears that such problems can be solved systematically, economically, and with acceptable accuracy by using the variational synthesis method. This method provides the means for obtaining approximate solutions for problems in multidimensional structures by joining together solutions of similar problems of lesser dimensionality and/or guesses for solutions based on intuition or past experience. Author (TAB)

N69-24710* Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SHUTDOWN CHANNELS AND FITTED INTERLOCKS IN ATOMIC REACTORS [CHAINES DE SECURITE ET VERROUILLAGES INSTALLES SUR LES PILES ATOMIQUES]
Jacques Furet and Claude Landauer Oct. 1968 28 p In FRENCH (CEA-R-3550) Avail: AEC Depository Libraries

Tables of data on safety circuits in French critical assemblies, research reactors, and power reactors are presented. Included are: number and type of detectors, range of the shutdown channels, nature of the associated electronics, alarm threshold settings, and fitted interlocks. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N69-23385 George Washington Univ., Washington, D. C.
THE STUDY OF ELECTRICAL CONDUCTION PROPERTIES OF POINT-TO-PLANE ELECTRODES AND THEIR INFLUENCE ON THE ACCURACY OF FORCE MEASUREMENTS, VOLUMES 1 AND 2
Soadjana Sapiie (Ph.D. Thesis) 1968 208 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-14540

The voltage-current characteristics on both polarities showed distinctly the existence of three regions, each governed by its own conduction mechanism. The upper region of the voltage-current characteristic is the corona region. The corona starting voltages were determined by two methods: the observation of the current wave shapes, and the measurement of the direct current component in the microampere region. On the direct current detection, the measurement thresholds were investigated in terms of the computed signal to noise ratio. The results were compared with the theoretical thresholds for self-sustaining discharges. The concept of partial breakdown was introduced, and it was found that the theoretical force formula, under ideal as well as partial breakdown conditions, was the same. The corrections for the theoretical forces were investigated for the most pessimistic cases. Dissert. Abstr.

N69-23399 Carnegie-Mellon Univ., Pittsburgh, Pa.
A NEW SPECTROSCOPIC METHOD OF HIGH PRESSURE ARC DIAGNOSTICS
Teh-Sen Jen (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-10708

General properties of the resonant-line spectral profile emitted by high pressure arcs are investigated. The shape of the strongly broadened and greatly reversed profile is studied using the computed D-line profiles from sodium dc arcs as the studying samples, and the relationship to the key plasma parameters is established. It is found that the relative intensities at the lateral peaks of the resonant profile are proportional to the corresponding intensities in the Planck spectrum for an "effective central temperature" T_e. This T_e is uniquely related to the actual central temperature with only slight dependence upon the shape of the temperature profile. It is also found that the average optical depth at the lateral peaks from the arc edge to its center is unity; this leads to a relationship between the separation of the lateral peaks and the vapor pressure. Other important properties are also obtained. Dissert. Abstr.

N69-23408 University of Southern Calif., Los Angeles.
A GENERALLY COVARIANT FORMULATION OF CLASSICAL ELECTRODYNAMICS FOR CHARGES OF FINITE EXTENSION
Ronald Jack Crowley (Ph.D. Thesis) 1968 163 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-13573

General covariance is maintained throughout by the use of n-tensors, the nonlocal generalization of ordinary tensors. The nonelectromagnetic forces which are necessary for the stability of the charge are taken into account, in a phenomenological way, by requiring that the charge distribution maintain a given rigid spherically symmetric shape throughout its motion, rigidity being defined from the point of view of a single observer who moves with the charge center. A general prescription is given for the construction of spherically symmetric charge-current densities. The rotational and translational equations of motion as well as the gravitationals and electromagnetic field equations are obtained for the rigid spherically symmetric charge distribution interacting with an external field. An approximation to the translational equations of motion is obtained by making a perturbation expansion in powers of the size of the charge distribution. Of particular interest is the appearance, within the radiative reaction force term, of a term which is proportional to the Ricci tensor. Dissert. Abstr.

N69-23425 California Univ., Berkeley.
ELECTRICAL PROPERTIES OF VERY THIN CESIUM LAYERS ON INSULATORS
Theodore Irving Kamins (Ph.D. Thesis) 1968 237 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 68-13920

Theoretical and experimental results are presented which help to clarify the nature of the electrical conductance in thin cesium layers adsorbed on insulating substrates. It is concluded that the Cs is adsorbed in atomic form, that the dipole moment in the Cs layer is directed toward the insulating substrate, and that the ionization energy of the adsorbed atom is much less than that of the free atom. Energy considerations indicate that little three-dimensional aggregation is expected in a Cs film adsorbed on glass. The lateral interadsorbate forces in the film are due to non-polar van der Waal's interactions. A model describing the adsorption kinetics is proposed; it is postulated that most of the desorbing atoms move from the dense first layer into the dilute second layer before desorbing from the film. This model predicts a nearly constant heat of adsorption, which is consistent with experimental observations. Dissert. Abstr.

N69-23431 Temple Univ., Philadelphia, Pa.
OPTICAL PROPERTIES OF ELECTRONS IN METALS
Robert John Esposito (Ph.D. Thesis) 1968 196 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-14129

Utilizing the Bohm-Pines formulation, the optical absorbing power is calculated to second order of a high density electron gas in the long wavelength limit. The optical properties of the electron gas contained within a thin slab are shown to be markedly different from those of a bulk gas provided that the lifetime of the excited particles is sufficiently long for the particles to feel their containment within the slab. Bulk and thin film absorption processes are predicted to be within the range of experimental observation in certain free electron-like materials. Dissert. Abstr.

N69-23483 North Carolina State Univ., Raleigh.
A STUDY OF IRON AS A RECOMBINATION CENTER IN GERMANIUM BY A TRANSIENT p-n JUNCTION TECHNIQUE
William Bryan French, II (Ph.D. Thesis) 1968 77 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-14854

Iron in germanium acts as a multivalent recombination center for carriers. The energy of the iron center is a function of its charge condition. The iron has a capture cross section for electrons and holes at each energy level. It was the purpose of this work to measure these four capture cross sections. To determine the cross sections, recombination of the carriers was studied by the decay of the voltage across a p-n junction after the junction has been forward biased and then open-circuited. Devices were prepared by diffusing iron into germanium and by constructing alloyed diodes. A theoretical model was developed which gave an analytic expression relating the post-injection emf to the recombination as a function of excess carrier density. Capacitance versus reverse bias data was used to determine the number of active iron centers in the germanium lattice. Dissert. Abstr.

N69-23488 Syracuse Univ., N. Y.
NOISE GENERATION BY HIGH-SPEED AXISYMMETRIC JET FLOWS INTERACTED WITH RADIALLY IMPINGING ANNULAR JET FLOWS
Francis James Montegani (Ph.D. Thesis) 1968 209 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-13852

A unique approach to supersonic-jet noise reduction was investigated using the impingement of radial annular jet flow upstream of the first shock cell-end of a moderately underexpanded main jet flow. Such an impingement results in a modification of the main jet shock structure which is known to play an important role in jet noise generation; and the modification of this shock structure, which would modify also the emitted noise, was the fundamental motivation for the approach. Acoustical and shadowgraphic data were obtained in an anechoic chamber. The principal experimental variables were the amount of impinging flow, and the impingement location. Various nozzle arrangements were employed which differed principally in regard to the provision made for entrainment by the jets upstream of the impingement location. Dissert. Abstr.

N69-23522 California Univ., San Diego.
THE MAGNETIC PROPERTIES OF TRANSITION METALS
Dieter Karl Wohlleben (Ph.D. Thesis) 1968 176 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-13807

Measurements of the susceptibility of pure Sc, Y and La and of dilute alloys of nonmagnetic metals with Sc between 0.38 and 300°K are given. The susceptibility of Sc is 15% larger than previously reported. It is very sensitive to a reduction by nonmagnetic heavy impurities via spin orbit coupling. This interaction is also effective in reducing the susceptibility of pure polycrystalline Sc and Y with respect to the single crystal. The susceptibility of pure polycrystalline La is abnormal because it does not show the parabolic temperature dependence expected from Fermi statistics down to 2°K. The saturation moment of Gd ions dissolved in Sc and Y at extreme dilution (100 ppm) was also studied. It is more than 9.9μ_B in Sc and 7.6 μ_B in Y. This enhancement is contrasted to the decrease of the moment on Gd in Pd. Dissert. Abstr.

N69-23623 California Univ., San Diego.
THEORY OF GALVANOMAGNETIC EFFECTS IN DILUTE MAGNETIC ALLOYS
Richard Michael More (Ph.D. Thesis) 1968 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-14036

Some galvanomagnetic properties of dilute magnetic alloys are calculated on the basis of the so-called "s-d model," using S-matrix theory to calculate the conduction electron scattering by a magnetic impurity. The calculation involves an approximate but analytically consistent solution of the partial-wave dispersion relations for the scattering amplitudes of the conduction electrons with energies near the Fermi energy. Detailed evaluations are presented of the Hall coefficient and of the magneto-resistance. The results are compared with available experimental data. In a number of cases, qualitative agreement with the experimental data is achieved. Dissert. Abstr.

N69-23549 Pittsburgh Univ., Pa.
INDUCTION HEATING OF A FERROMAGNETIC CYLINDER THROUGH THE CURIE TEMPERATURE
Richard Edward Kothmann (Ph.D. Thesis) 1968 201 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68/14176

The heat transfer and electromagnetic processes are investigated which occur when a ferromagnetic cylinder is heated through the Curie transformation by an induction heating coil. An analytical model is developed to predict the temperature distribution in the cylinder and the accompanying electrical loading of the induction coil as functions of time. The results of the analysis are compared with experimental data from tests in which five-inch diameter steel cylinders were heated in an eight-inch diameter induction heating coil using frequencies of 60 and 180 cycles/sec. The data include temperatures at various positions within the cylinders and the electrical parameters needed to determine the coil impedance and efficiency. Dissert. Abstr.

N69-23555# LTV Electrosystems, Inc., Greenville, Tex.
SHIELDING DESIGN CALCULATION FOR SYSTEMS ELECTROMAGNETIC COMPATIBILITY
Apr. 1969 13 p refs
(G3695.00.04A) Avail: Issuing Activity

Protection of electronic equipment from spurious signals is a necessity for system compatibility. The type of material used depends on whether the susceptible equipment is located in the induction or radiation field of the source. Knowledge of the behavior of electromagnetic waves is the foundation upon which the designer must base the choice of shielding material. Design equations with graphical solutions are presented along with illustrative examples. The basic properties of electromagnetic fields and the selection of shielding materials are discussed. Author

N69-23571 Colorado Univ., Boulder.
MICROWAVE SPECTRUM OF VIBRATIONALLY EXCITED ALLENE AND CHLOROFORM AT AROUND 4 MILLIMETERS
Adalbert Emanuel Goertz (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-14381

Purely rotational absorption in the molecules belonging to the point group D_{2d} is possible, when the molecule is excited in a degenerate vibrational state. The Boltzmann factor is favorable for the lowest of the four vibrations of the degenerate species E in allene. The rotational transition frequency for J: 3 → 4 is measured, its rotational constant, its rotation-vibrational interaction constant are determined, and its line width is measured. The accuracy of the latter measurement is not good. Some vibrational fine structure lines of chloroform are measured. They correspond to the rotational transitions J: 9 → 10, and J: 10 → 11. Some rotation-vibrational interaction constants are determined, others are predicted from corresponding data of fluoroform. Quadrupole hyperfine structure is not resolved. The experimental apparatus, the frequency measurement and control, the absorption cell and the Stark modulation is described. Dissert. Abstr.

N69-23577* Houston Univ., Tex. Wave Propagation Labs.
ANALOGIES BETWEEN EM AND ACOUSTIC WAVES
H. S. Hayre and G. Vroulis Nov. 1968 31 p refs
(Contract NAS9-7828)
(NASA-CR-99622; TR-68-19) Avail: CFSTI CSCL 20A

The purpose of this report is to summarize the results of a considerable amount of work in the field of acoustic simulation of radar return, so that, the radar may be readily confident about the validity of this inexpensive laboratory tool. Acoustic simulation readily permits experimental verification of scatter theories which would otherwise be costly and time consuming. Author

N69-23578 Rensselaer Polytechnic Inst., Troy, N. Y.
ELECTROMAGNETIC SCATTERING BY SPHERES OF ANISOTROPIC REFRACTIVE INDICES
Ru-Tsang Wang (Ph.D. Thesis) 1968 222 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 68-13528

The experiment uses a linearly polarized microwave radiation of wavelength $\lambda = 3.18$ cm, and emphasis is placed on the measurement of the complex amplitude of the forward scattered wave by displaying its two time-quadrature components on an X-Y recorder, from which the extinction cross section of the scatterer can also be reduced using the optical theorem. The history of the development of this technique at this Institute is also described in some detail. Rough back scattering studies are also added to supplement the forward scattering data. Anisotropic spheres of several degrees of anisotropy in the size range $2.6 \leq 2\pi a/\lambda \leq 5.8$ were studied. They are constructed out of fine layered composite media alternately conducting (or absorbing) and dielectric. The microwave properties of these materials for 3 principal orientations of the layered medium with respect to the incident-wave polarization are measured by the waveguide-slotted-line technique. Dissert. Abstr.

N69-23610 Yale Univ., New Haven, Conn.
NUMERICAL STUDIES OF THE GRAVITATIONAL PROBLEM OF N BODIES
Erland Myles Standish, Jr. (Ph.D. Thesis) 1968 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-14851

A computer program is developed to integrate numerically the equations of motion of the gravitational problem of n bodies. Two principal investigations are made with the use of the program. Microscopic instability is defined for a gravitational system of n bodies, and it is illustrated numerically. The dynamical cause is found to be the effect of close encounters between the individual particles—not the collective effect of a tightly coupled system. The implication of the instability regarding the results of investigations of systems of n bodies are illustrated and discussed. Extended integrations of the equations of motion of 25-, 50- and 100-body systems are made. Effects dependent on the number of particles in the system are evident. Most often, however, the dynamical effects can not be separated from those normally expected of random fluctuations. The evolution of collapsing clusters is shown to begin with a violent initial stage. Dissert. Abstr.

N69-23641 Texas Univ., Austin.
STARK BROADENING OF BALMER LINES IN A RADIO-FREQUENCY DISCHARGE
James Arthur Durham (Ph.D. Thesis) 1968 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-16072

Stark broadening of Balmer lines emitted from a radio frequency discharge is studied by folding non-Stark and Stark effects to obtain theoretical line profiles. For comparison, a set of experimental profiles is obtained for a range of temperatures and densities of astrophysical interest. An empirical approximation to Stark broadening is suggested, which makes use of the quasi-static formalism and a variable effective quasi-static perturber density. This approximation is based on the idea that contributions from impact regime electrons are small. Comparison of derived profiles (using the empirical approximation mentioned) with experimental profiles shows excellent agreement. This empirical approximation should be extremely useful as a concise, closed-form summary of the experimental data, and may help to stimulate revisions of the generalized impact theory. Dissert. Abstr.

N69-23714 ITT Research Inst., Chicago, Ill.
A NEW SPECTRAL SENSITIZATION MECHANISM IN ZINC OXIDE THIN FILMS
Stanley Joseph Dudkowski (Ph.D. Thesis) 1968 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-14189

The photoconductivity of zinc oxide thin films is increased by a factor of approximately 10^4 at visible wavelengths by the adsorption of a layer of an organic dye: eosin, crystal violet, methylene blue, or acridine orange. The experimental conditions affecting spectral sensitization of zinc oxide thin films have been investiged. A Schottky barrier model is proposed to describe the phenomenon. The films were prepared by oxidation of vacuum-evaporated metallic zinc films. The dye layers were adsorbed on the film in aggregated form by solvent evaporation. The photoresponse measurements were made in a cryostat evacuated to 10^{-6} torr. Photoconductivity was calculated from the voltage drop across external series load resistances. The illumination sources used were a tungsten filament lamp for steady-state and slow photoconductivity excitation, and a high-intensity xenon flash lamp for the fast, transient photoconductive responses. Each source was filtered by monochromators or appropriate glass filters. The action spectra, build-up and decay rates, dependence of the steady-state photocurrent on the dark current, excitation intensity, and temperature were measured. Dissert. Abstr.

N69-23716*# Wyle Labs., Inc., Huntsville, Ala. Research Div.
AN EXPERIMENTAL INVESTIGATION OF PRESSURE FLUCTUATIONS CAUSED BY THE INTERACTION OF TURBULENCE WITH SHOCK AND EXPANSION WAVES
S. W. Radcliffe Mar. 1969 96 p refs
(Contract NAS8-21100)
(NASA-CR-98391; WR-69-7) Avail: CFSTI CSCL 20A

An experiment to observe the acoustic waves generated in the interaction of turbulence with a shock wave is described. The wake of a flat plate mounted in the centerline of a supersonic wind tunnel acted as the turbulence environment, and the shock wave was caused by a wedge. Observations were primarily made by the traversing of a miniature microphone mounted in a movable instrument head. The most closely examined configurations involved flow Mach numbers of 1.99 and 3.14 and a wedge angle of 10 degrees. An increase in the fluctuating pressure level was observed within the region where it would be expected, although no positive identification of the acoustic nature of the fluctuations was possible. Fluctuating pressure levels which were measured were generally about 8 dB higher than those predicted. An account of an unsuccessful attempt to measure increased fluctuating pressures due to the interaction between turbulence and an expansion fan is also given. Author

N69-23723 Arizona State Univ., Tempe.
SHOCK WAVE COMPRESSION OF BENZENE, CARBON DISULFIDE, CARBON TETRACHLORIDE, AND LIQUID NITROGEN
Richard Dean Dick (Ph.D. Thesis) 1968 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-14990

Shock waves generated by high explosives were used to obtain Hugoniot data for benzene, carbon disulfide, and carbon tetrachloride initially at 300°K and liquid nitrogen initially at 75°K. From these data and the known dural equation of state, the Hugoniot curves for the liquids were determined by means of the conservation relations and continuity conditions. Dynamic pressures achieved ranged from 20 to 600 kbar in the samples. A plot of the shock velocity versus particle velocity data for benzene reveals three regions each of which is described by a linear relationship. This is indicative of a transition occurring at 125 kbar and ending at 180 kbar. Although carbon disulfide and carbon tetrachloride are normally insulators, both become electrically conductive at pressures near 70 kbar. Some thermodynamic quantities such as temperatures on the Hugoniot, isentropes, and isotherms were calculated using a computer program. Dissert. Abstr.

N69-23733 North Carolina State Univ., Raleigh.
COUPLE STRESSES IN ELECTROSTRICTION AND MAGNETOSTRICTION
Claud Ervin Pugh (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-14670

The theory governing homogeneous, isotropic, elastic dielectrics with the inclusion of couple stresses is formulated. The linearized theory is then derived from the general constitutive relations. A Papkovitch-Neuber representation of displacement solutions is presented for the uncoupled linear theory. The use of these potential functions is illustrated by obtaining the solution to the problem of an infinite elastic dielectric containing a circular cylindrical cavity and subjected to a uniform electric field applied at infinity in a direction which is transverse to the axis of the cavity. The displacements, the symmetric part of the force stresses, and the deviatoric part of the couple stresses which result are determined in closed form, assuming plane strain conditions. The theory of magnetizable elastic bodies in the presence of a magnetic field is also put forward. Dissert. Abstr.

N69-24298# Bendix Corp., Southfield, Mich. Research Labs.
SOUND HOLOGRAPH REAL-TIME DISPLAY TUBE Interim Report, 1 May– 31 Aug. 1968
George G. Goetz Aug. 1968 33 p refs
(Contract N00014-68-C-0338)
(AD-680251; ALD-4601) Avail: CFSTI CSCL 21/1

An investigation was conducted directed toward developing a real-time display tube for an imaging system based on acoustic holography. Of the techniques capable of modulating light with the speed and resolution desired, an electrooptic display tube employing deuterated KH2PO4 (DKDP) appeared best suited for the system. A demountable tube was built to verify the approach. It was concluded that such a tube is feasible if polishing techniques are developed which yield flat surfaces on DKDP crystals sufficiently thin to produce the required resolution. Author (TAB)

N69-24332*# Spectrolab, Inc., Sylmar, Calif.
ULTRAVIOLET FILTER
Samuel J. Holmes, inventor (to NASA) Issued 11 Feb. 1969 (Filed 12 Mar. 1965) 4 p Cl. 350-1
(Contract NAS5-519)
(NASA-Case-XNP-2340; US-Patent-3,427,089; US-Patent-Appl-SN-439490) Avail: US Patent Office CSCL 20F

A filter of the Fabry-Perot interference type is described which will pass a band of ultraviolet radiation in the region of 2,150 Å. It has approximately an 80% transmission efficiency, while rejecting sideband radiation of longer and shorter wavelengths. The filter has a base of ultraviolet transparent material, and a filter coating deposited on the base of alternate thin film layers of thorium fluoride and cryolite. The thorium fluoride is used as the high index of refraction material, and the cryolite is used as the low index of refraction material. Official Gazette of the U.S. Patent Office

N69-24485# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
APPLICATION OF AN ACOUSTIC ROOM MODELING METHOD, SCALE 1:10, TO SOLVE ACOUSTIC PROBLEMS IN BUILDINGS [DIE ANWENDUNG DER METHODE RAUMAKUSTISCH AEHNLICHER MODELLE IM MASSSTAB 1 : 10 ZUR LOESUNG BAUAKUSTISCHER PROBLEME]
Stephan Zumatzis (Ph.D. Thesis) 1968 100 p refs In GERMAN
Avail: CFSTI

A scaled acoustic room model with sound transmission and receiving equipment was built according to specification standards for radio studios, and acoustic damping measurements were obtained for various building materials at standardized dimensions. Measured were structure borne sound absorption and damping properties as well as coincidence effects of bypass sound transmission on partition sound proofing. Acoustic damping measurements on double wall constructions with increased air spaces showed increased soundproof properties when damping pipes were fastened to one wall. Transl. by G.G.

N69-24850# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
WAVES IN DEFORMED COAXIAL CABLES [WELLEN IN DEFORMIERTEN KOAXIALKABELN]
Edmund Abaka (Ph.D. Thesis) 1968 20 p refs In GERMAN
Avail: CFSTI

The behavior of electromagnetic waves in cables which have a characteristic impedance of 50 Ω in undeformed condition is examined, with emphasis on the study of waveguides. The following cable forms are considered: (1) round coaxial; (2) lunar tubular waveguide; (3) elliptical coaxial; (4) inverse-elliptical coaxial; and (5) the general asymmetrical case. Direction of propagation, field strength components, and the solution of the potential and wave equations are briefly discussed. A conformal representation is used to transform a Cartesian coordinate system for rectangular waveguide sections into an orthogonal curvilinear coordinate system. The conformal representation requires only one computer program, and an ALGOL program was used in this study to obtain cutoff frequencies for wave propagation in waveguides. Transl. by K.W.

N69-24676# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
TOTAL REFLECTION PHENOMENA IN SECOND HARMONIC GENERATION OF LIGHT

N. Bloembergen, H. J. Simon, and C. H. Lee Dec. 1968 45 p refs
(Contract N00014-67-A-0298)
(AD-682931; TR-582) Avail: CFSTI CSCL 20/6

The direction, polarization and intensity of second harmonic light beams, generated in a crystal of NaClO3 were observed as a function of the angle of incidence, when the primary laser beam is incident from a denser linear fluid. When the angle of incidence theta sub i is smaller than the critical angle for total reflection critical theta (omega), a reflected harmonic beam and two distinct spatially resolved transmitted harmonic beams with polarizations processing in opposite senses are observed. When critical theta (2 omega) > theta sub i > critical theta (2 omega) the incident laser power is totally reflected, but one of the transmitted harmonic beams still exists. For theta sub i > critical theta (2 omega), only the reflected harmonic beam remains. When two totally reflected laser beams are incident from opposite sides of the normal, second harmonic radiation occurs in the direction of both the inward and outward normal. The results agree quantitatively with the theory of Bloembergen and Pershan. Author (TAB)

N69-24725# TRW Systems, Redondo Beach, Calif.
RADIATION MEASUREMENTS FROM A PULSED HIGH-PRESSURE NITROGEN ARC Final Report
R. Goldstein and F. N. Masstrup Aug. 1968 85 p refs
(Contract AF 33(615)-5363)
(AD-680467; ARL-68-0152) Avail: CFSTI CSCL 13/1

The program was an experimental and theoretical determination of the ultraviolet and vacuum ultraviolet emission from pulsed high pressure nitrogen arcs at pressures up to 1000 atm. For this purpose, a pressure vessel was designed and constructed for the containment of gas pressures up to 1000 atm. In addition, an ignition mechanism, which allowed breaking down of 1000 atm nitrogen arc gaps of 1/4 inch and a pulse forming network, which discharged rectangular current pulses of 2 - 10 kiloamperes magnitude and 650 microseconds duration through the 1000 atm nitrogen was designed and constructed. The breakdown apparatus utilized an ignition wire across the gap. High speed pictures of the discharge showed that a luminous plume, with hot spots, and not a cylindrical discharge, resulted from the discharge. Photographic spectra showed the 1000 atm nitrogen arc emission was primarily a continuum in the spectral region 1950 - 3000 A; no line emission was observed in the spectral region 1450 - 3000 A. Although local thermodynamic equilibrium was expected, the radiation pulse shapes at several wavelengths in the region 1600 - 4000 A showed erratic behavior and a quasi-stationary state was obtained at all studied wavelengths, only near the end of the rectangular discharge (500 - 700 microseconds after ignition). Quantitative measurements of the spectral radiance of a 1000 atm nitrogen arc with 4 kiloamperes current in the region 1700 - 4000 A at this quasi-stationary state, showed that the emission was a continuum, peaking at 2500 - 3000 A, and becoming extremely weak at wavelengths smaller than 1900 A. Author (TAB)

N69-24730# Rutgers Univ., New Brunswick, N. J. Dept. of Physics.
STUDIES OF SUPERCONDUCTING FILMS Final Report, 1 Jul. 1966–30 Jun. 1968
Bernard Serin Jun. 1968 15 p refs
(Contract DA-28-043-AMC-02486(E))
(AD-680582; ECOM-02488-F; Rept-8) Avail: CFSTI CSCL 20/3

The scientific achievements include: (1) A study of the anisotropy in the thermal conductivity of thin superconducting films. (2) Thermal conductivity measurements over an extended temperature range of thin film sandwiches of an alloy superconductor between layers of manganese. The data provide evidence that the superconducting film is gapless near the magnetic interface. (3) Measurements of the temperature dependence of the surface reactance of lead films in proximity with gadolinium. These data have been compared with the predictions of the Ginzburg-Landau theory and the microscopic theory. (4) The start of the investigation of fluctuations above Tc in superconducting lead films by measurement of the rounding of the resistive transition. Author (TAB)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N69-23372 Colorado Univ., Boulder.
THE LAMB SHIFT IN SINGLY IONIZED HELIUM
Musti Appala Narasimham (Ph.D. Thesis) 1968 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-14393

The energy difference between the 2^2S-1/2 and 2^2P-1/2 states of singly ionized helium has been measured accurately using a microwave power method. Helium atoms inside a spherical mirror Fabry Perot resonator are bombarded continuously by electrons of 200 eV energy to produce helium ions in the 2^2S-1/2 metastable state. Transitions are induced in these metastable ions by the applied, modulated rf power of constant frequency to the short lived 2^2P-1/2 ionic state. The 40.8 eV photons emitted by the decay of the 2^2P-1/2 ions to the ionic ground state are quantum converted to visible photons by a scintillator and are then guided to a photomultiplier. The output of the photomultiplier is detected and amplified synchronously with the rf power. The experiment has made use of the Zeeman effect of the fine structure and is done in an applied homogeneous magnetic field. Dissert. Abstr.

N69-23386 Yale Univ., New Haven, Conn.
NUCLEAR STRUCTURE OF MANGANESE-58
Joseph Robert Comfort (Ph.D. Thesis) 1968 273 p
Avail: Univ. Microfilms: HC $12.40/Microfilm $3.55 Order No. 68-14842

The $Mn^{55}(d,p)Mn^{56}$ reaction is studied with 10 keV resolution at a deuteron bombarding energy of 7.5 MeV using the Van de Graaff accelerator and multigap magnetic spectrograph. Angular distributions are obtained for most states up to 5.5 MeV and for strong states up to about 6.5 MeV of excitation energy. A distorted-wave (DW) analysis is carried out in order to extract the orbital angular momentum transfer l_n and the transition strength $(2J_f + 1)S_f$ for each state. Very careful consideration is given to the selection of optical-model parameters. The DW analysis reveals the presence of considerable configuration mixing in the Mn^{56} spectrum. The $l_n = 3$ spectroscopic factors for the ground and first excited states are about twice as large as those for $l_n = 1$. Parities are assigned to states which exhibit clearly identifiable stripping patterns. A discussion of possible spin assignments is given, particularly for the states below 1 MeV of excitation energy. Dissert. Abstr.

N69-23386 Colorado Univ., Boulder.
ELECTROMAGNETIC INTERACTIONS OF BARYONS IN DYNAMICAL GROUP THEORY
Dennis Corrigan (Ph.D. Thesis) 1968 203 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-14374

Dynamical group theory is used to provide a framework for computation of electromagnetic properties of hadrons and hadron resonances. The theory makes use of purely algebraic methods only. Several models are investigated as illustrations of the general theory. The most successful model is one which uses O(4,2) as the dynamical group. Nucleon electromagnetic form factors are predicted in excellent agreement with experiment. Transition form factors to excited states N^* are also calculated with this model, and the predictions are compared with the small amount of experimental data presently available. The problem of the inclusion of internal symmetries is examined in some detail. Two models which incorporate internal symmetries are described. Dissert. Abstr.

N69-23387 Sakatchewan Univ., Saskatoon.
STUDY OF PHOTONEUTRONS FROM Al^{27}, Si^{28}, P^{31} AND S^{32}
Sang Hae Ku (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-14629

Photoneutron spectra and angular distributions from Al^{27}, Si^{28}, P^{31} and S^{32} produced by $E_{\gamma max}$ = 103 MeV bremsstrahlung have been measured. The spectra were obtained simultaneously at five angles using time-of-flight techniques. In the giant resonance region of the nuclei, the positions of resonance peaks are in good agreement with previous experiments, and the angular distributions are practically independent of the neutron energy. It is not possible to determine the multipolarities involved or to compare our data quantitatively with theory due to the complexity of the spectrum. Above the giant resonance region, the yields at 90° fall off nearly exponentially and the angular distributions show a forward peaking which becomes more pronounced with increasing neutron energy. The angular distribution and yield are compared with existing models. Dissert. Abstr.

N69-23423 European Organization for Nuclear Research, Geneva (Switzerland). Health Physics Group.
THE ESTIMATION OF THE DISTRIBUTION OF ENERGY LOSS OF IONIZING RADIATION FROM OBSERVATIONS OF THE INITIAL RECOMBINATION OF THE IONS IN A GAS
A. H. Sullivan (Ph.D. Thesis--London Univ.) 28 Jan. 1969 94 p refs
(CERN-69-1) Copyright. Avail: Issuing Activity

The importance of ionization density in radiobiological processes, and the concepts involved, are briefly reviewed. Initial recombination theory is developed to a stage where it can be used to estimate the distribution of energy absorbed as a function of the size of ionization events from observations of the dependence of the collected ion current on applied electric field and gas pressure in a suitable ionization chamber. An ionization event is defined from the theory and is the ionization produced over a distance equivalent to about 700 Å in tissue. The experimental and theoretical problems involved are investigated in detail and it is shown that the method can only have a rather poor resolution and reproducibility. Distributions are experimentally determined for ^{60}Co, ^{137}Cs and ^{226}Ra gamma rays. PuBe, 3 MeV, 15 MeV and fission neutrons and for alpha particles from plutonium. Author

N69-23424 Syracuse Univ., N. Y.
SCATTERING OF HIGHLY SPIN-POLARIZED ELECTRONS IN SILICON
Roger Louis Maxwell (Ph.D. Thesis) 1968 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-13850

The spin-polarization dependence of electrons scattered from neutral phosphorus impurities in silicon is investigated. The method consists of measuring the photocurrent in a silicon sample as a function of the electronic spin-polarization, which was variable between zero and about 95% through use of magnetic fields up to 12 kOe and temperatures down to 0.35°K. The zero kinetic energy singlet and triplet scattering lengths for scattering of an electron from a neutral phosphorous donor were determined, and compared with theoretical calculations made on electron-hydrogen scattering. The agreement demonstrates within certain limits the adequacy of the effective mass scaling for this type of collision problem. The theory has been extended to consider the coherent scattering of electrons from neutral phosphorous impurity pairs, which occurs at high impurity concentrations. Dissert. Abstr.

N69-23456 California Univ., Berkeley.
RESONANCE PRODUCTION, PARTICULARLY Y (1385) AND RHO MESON, IN NEGATIVE KAON PROTON YIELDS A HYPERON POSITIVE NEUTRAL AND NEGATIVE PIONS AND NEGATIVE KAON PROTON YIELDS A HYPERON POSITIVE AND NEGATIVE PIONS FROM 2.1 TO 2.7 BeV/c
Daniel Menahem Siegal (Ph.D. Thesis) 1968 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-13957

Some 20,000 $K^-p \rightarrow \Lambda\pi^+\pi^0\pi^-$ and 10,000 $K^-p \rightarrow \Lambda\pi^+\pi^-$ events are identified in the 72-inch hydrogen bubble chamber. Analysis of these reactions, by means of maximum likelihood fits to comprehensive models involving known resonances, yield cross sections and production angular distributions for quasi-two body states $Y_1^*(1385)^+_{\rho}$ $\rho\,\overline{o}_{+}$, $Y_1^*(1385)^{\pm}\,\pi^{\mp}$, and $\lambda^*\rho^*$. Analysis of decay angular distributions for peripheral reactions indicates predominance of K meson exchange for $K^-p \rightarrow Y_1^*(1385)^+\rho^-$, $Y_1^*(1385)^+\rho^-$, and K^* exchange for $K^-p \rightarrow Y_1^*(1385)^+\pi^-$. Dissert. Abstr.

N69-23461 Arizona State Univ., Tempe.
CONJUGATE POINT PROPERTIES FOR n ORDER LINEAR DIFFERENTIAL EQUATIONS
Grant Bernard Gustafson (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-14995

Conjugate point properties are established for the general n^{th} order linear differential equation. Existence of the derivative of the first conjugate function is examined, and this investigation is used to establish solvability theorems for certain interpolation problems. These solvability theorems are employed to characterize equations of arbitrary order generated from second order equations. It is shown that a characterization of the oscillatory behavior of the general n^{th} order linear differential equation cannot be obtained solely from the introduction of conjugate points. Dissert. Abstr.

N69-23473 Brigham Young Univ., Provo, Utah.
EXPERIMENTAL MELTING CURVES OF CADMIUM, INDIUM, LEAD, TIN, AND ZINC AND MOESSBAUER MEASUREMENTS IN IRON TO 90 KILOBARS
Lorin Edward Millet (Ph.D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-13490

The fusion curves of Cd, In, Pb, Sn, and Zn were experimentally determined to 90 kbar by resistance measurements in a tetrahedral

anvil press, with some supportive latent heat and thermal analysis data. The corrected melting temperatures are estimated to be accurate to ±1% of the absolute temperature, and the corrected pressures to ±3%. The tin I-II solid phase transformation was also followed from the triple point at 309 ± 5°C and 32 ± 1 kbar to 107 ± 3°C at 65 ± 3 kbar. The data obtained were corrected by applying chromel-alumel thermocouple corrections of Hanneman and Strong, and pressure corrections for thermal expansion and redistribution of pressure gradients which occur upon heating. Mössbauer measurements of Fe^{57} in iron were made near the α-γ triple point from 28 to about 640°C with some supportive resistance measurements. Dissert. Abstr.

N69-23486 California Univ., Berkeley.
HYPERFINE STRUCTURE OF Dy 165 AND SPIN OF Er 163
Sanford Stein (Ph.D. Thesis) 1968 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-13961

The atomic beam magnetic resonance flop-in method was used to measure the hyperfine structure of Dy^{165} and the spin of Er^{163}. The results for the $_{22}Dy^{165}_{99}$ ground state are a = ± 89.8(7) MHz, and b = ± 1520(30) MHz where a and b are the magnetic dipole and electric quadrupole hyperfine interaction constants. The spin was previously measured to be I = 7/2. From these values one can calculate the nuclear magnetic dipole moment and the nuclear electric quadropole moment. The spin of the ground state of $_{68}Er^{163}_{95}$ is I = 5/2 which agrees with the Nilsson state assignment. The theory underlying the atomic beam method, a description of the technique and equipment used, and a comparison with appropriate theoretical calculations are presented. Dissert. Abstr.

N69-23487# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica
ALGEBRA OF CURRENTS. 1.
L. Miani and G. Preparata 1 Oct. 1968 63 p refs
(ISS-68/32) Avail: CFSTI

Results obtained from the algebra of currents introduced by Gell-Mann are reviewed. A detailed discussion is included on the derivation of sum rules (Adler-Weisberger, Cabibbo-Radicati, etc.), either with the $p \to \infty$ method or with the covariant method. Theorems for the emission of zero energy pions are discussed and applied to leptonic and non leptonic decays of K mesons, and to the 3π decay of the η meson. Recent developments of current algebra like the gauge fields current algebra, the Weinberg sum rules, and the applications of the Bjorken's methd to weak and e.m. interactions are also discussed. Author

N69-23490*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATIONS OF AUGER AND PHOTOELECTRON SPECTROSCOPY
Le I Yin and Isidore Adler Apr. 1969 13 p refs Submitted for publication
(NASA-TM-X-63519; X-641-69-125) Avail: CFSTI CSCL 20H

The principles involved in the excitation and de-excitation of an atom which give rise to the emission of characteristic X-rays as well as Auger electrons and photoelectrons are reviewed. Analysis using magnetic and electrostatic electron spectrometers is discussed. Applications of this form of spectroscopy are treated, including binding energy determination from the photoelectron spectra, identification of elements and levels, work on the Auger transition, chemical shift determination, and studies of the vibrational levels of molecule ions. The sensitivity of the method for surface studies indicates its usefulness in monitoring surface contaminants, impurity concentrations in semiconductors, surface diffusion, adsorption and desorption processes, and many related phenomena. P.A.B.

N69-23492 Colorado Univ., Boulder.
A GROUP THEORETIC TREATMENT OF THE QUANTUM THREE BODY PROBLEM
Mordechai Halpern (Ph.D. Thesis) 1968 68 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-14217

By use of group theory a model three body problem is solved. Use is made of the groups SU(3) and SU(3,1) to represent the states of three spinless particles in the non-relativistic limit. The kinematic density of states factor is calculated by a new method using the density matrix. The next step is treatment of systems with different total mass as members of the same family, i.e., as different states of the same quantum mechanical system. This is done by the use of SU(3,1). The method of phase space filtering is introduced which is essentially using group symmetry to systematize the experimental study of the density matrix for three body systems. Dissert. Abstr.

N69-23495 California Inst. of Tech., Pasadena.
ENERGY TRANSFER IN MOLECULAR COLLISIONS
Merle Eugene Riley (Ph.D. Thesis) 1968 287 p
Avail: Univ. Microfilms: HC $13.05/Microfilm $3.70 Order No. 68-12758

Two general, numerically exact, quantum mechanical methods have been developed for the calculation of energy transfer in molecular collisions. Both methods have been applied to a collinear collision model for two diatoms, interacting via a repulsive exponential potential. Two major studies were performed. The first was to determine the energy dependence of the transition probabilities for an H_2 on H_2 model system. Transitions are possible between translational energy and vibrational energy, and from vibrational modes of one H_2 to the other H_2. The second study was to determine the variation of vibrational energy transfer probability with differences in natural frequency of two diatoms similar to N_2. Comparisons were made to previous approximate analytical solutions of this same problem. Dissert. Abstr.

N69-23500# Florida State Univ., Tallahassee.
RADIATION INDUCED LUMINESCENT PROCESSES IN GASES Progress Report
J. A. Llewellyn, R. E. Glick, and Russell J. Keirs 29 Nov. 1968 59 p
(Contract AT(40-1)-3349)
(ORO-3349-4) Avail: CFSTI

Luminescence induced by 5-MeV protons in N_2 and N_2 –O_2 mixtures was examined and the energy transfer mechanisms governing the intensities for the principal emissions were deduced. Quenching cross sections for two $N_2C^3\pi_u$ levels interacting with O_2 are provided by the kinetic analyses. Two experimental arrays, using a low-energy (keV) electron impact luminescence source, have been set in operation. These are capable of determining the spatial distribution of luminescence about the exciting electron beam and can operate from the near infrared to the vacuum uv. At low pressures an attempt has been made, using these sources, to establish for N_2 a list of excited species and their relative production rates as a basis for understanding the higher-pressure observations. Author (NSA)

N69-23503# Princeton Univ., N. J. Elementary Particles Lab.
X-RAY IMAGE INTENSIFICATION
Geo. T. Reynolds 25 Nov. 1968 25 p refs
(Contract AT(30-1)-3406)
(NYO-3406-12; TR-8) Avail: CFSTI

Some initial results are presented of efforts to adapt conventional image intensifiers to the studies of low-angle x-ray diffraction patterns, as an outgrowth of previous work in the imaging of radioactive tracer deposits of very low specific activity. NSA

N69-23509# Iowa Univ., Iowa City. Dept. of Chemistry.
STABLE ISOTOPE TRACER STUDIES Progress Report, 1 Mar. 1968–28 Feb. 1969
Gilbert Gordon 20 Nov. 1968 11 p refs
(Contract AT(11-1)-1780)
(COO-1780-3) Avail: CFSTI

The rapid mixing and mass spectrophotometric equipment were improved and calibrated. The reactions between U^{4+} or Fe(phenanthroline)$^{2+}$ and sodium chlorite are being studied. The reactions of chlorate and chlorite ions and chlorine dioxide with Fe(phenanthroline)$^{2+}$ were studied. Several oxidants were also reacted with Fe(phenanthroline)$^{2+}$ and the products studied. The effects of a variety of catalysts on oxygen transfer reactions and isotopic exchange reactions are being studied. NSA

N69-23514 Rensselaer Polytechnic Inst., Troy, N. Y.
OVERLAPPING FINAL STATE INTERACTIONS
William Hung-Ying Mak (Ph.D. Thesis) 1968 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-13522

Following the dispersion theory model of three body production and decay processes developed by Aitchison, an approximate iterative solution is formulated. The criterion for rescattering and the interpretation of the singularities after each iteration are given and extended to the evaluation of the γ-3π vertex, which occurs in the reaction $e^+ + e^- \rightarrow \pi^+ + \pi^- + \pi^0$. By assuming first a one dimensional representation for the two body π-π channel, an analog of the Aitchison equation is derived. Within such framework, this process is found to be a one final state interaction type. The Khuri-Treiman equation can be generalized to all angular momentum. It is found that the pure kinematical effects due to higher spin cannot be ignored in the rescattering region. In order to make the three pion system more amenable to numerical analysis, an integral equation is derived using a p-wave dominance in each two body channel. Dissert. Abstr.

N69-23521 California Univ., Berkeley.
A STUDY OF THE REACTIONS NEGATIVE KAON PROTON YIELDS PROTON ANTIKAON NEGATIVE PION, NEGATIVE KAON PROTON YIELDS PROTON ANTIKAON NEUTRAL PION NEGATIVE PION, AND NEGATIVE KAON PROTON YIELDS NEUTRON ANTIKAON POSITIVE PION NEGATIVE PION
Jerome Harold Friedman (Ph.D. Thesis) 1968 315 p
Avail: Univ. Microfilms: HC $14.20/Microfilm $4.05 Order No. 68-13904

The reactions $K^-p \rightarrow pK^-\pi^-$, $K^-p \rightarrow pK^0\pi^0\pi^-$, and $K^-p \rightarrow nK^0\pi^+\pi^-$ are studied in detail in the LRL 72-in. hydrogen bubble chamber in the center of mass energy range 2.27 to 2.51 GeV. Total cross sections for these reactions as a function of center of mass energy are presented. Copious resonance production is observed in all of these final states. This resonance production is studied with the aid of a maximum likelihood technique and the relative rates of the well known resonances are presented as a function of center of mass energy. The differential cross section and decay correlation parameters are measured as a function of production angle and center of mass energy for the reaction $K^-p \rightarrow K^{*-}_{1/2}(892)p$ using the likelihood method. The differential cross section and parameters of the joint decay angular distributions for the double resonance production reaction $K^-p \rightarrow K^{*-}_{1/2}(892)N^{*}_{3/2}(1238)$ are also measured as a function of production angle and center of mass energy. Dissert. Abstr.

N69-23524 Colorado Univ., Boulder.
THE ANALYSIS OF TWO-PION INTERACTIONS AND ELASTIC SCATTERING IN 2.36 GeV/c NEGATIVE PION PLUS PROTON REACTIONS
Ward Edward Schultz (Ph.D. Thesis) 1968 96 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-14398

A study is presented of $\simeq$ 22 200 events obtained when negatively charged pi mesons with a momentum of 2.36 GeV/c were incident on a 72-inch hydrogen bubble chamber. The purpose was a large statistics analysis of the production and decay of two-pion resonances in the $\pi^-\pi^0$p and $\pi^-\pi^+$n final states. The elastic scattering reaction was also studied and the differential cross section was determined from 3906 events. The cross sections were calculated for the various reactions initiated by the πp interactions. The rho meson was the only two-pion resonance directly observed in the two-pion effective mass distributions. Indirect evidence was found for another two-pion resonance (the ϵ^0) with mass and width approximately that of the rho (M$\simeq$ 785 and $\Gamma \simeq$ 150 MeV). This appears to be the most likely explanation for the observed asymmetrical decay of the ρ^0. Dissert. Abstr.

N69-23541# Brookhaven National Lab., Upton, N. Y. Physics Dept.
USE OF FSD BUBBLE DENSITY MEASUREMENTS FOR THREE BNL BUBBLE CHAMBER GROUP 80-INCH CHAMBER EXPERIMENTS
R. C. Strand, D. J. Crennell, W. E. Ellis, and I. O. Skillicorn 24 Oct. 1968 8 p refs Presented at Intern. Conf. on Advan. Data Process. For Bubble and Spark Chambers, Argonne, Ill., 28–30 Oct. 1968
(BNL-13012; Conf-681025-6) Avail: CFSTI

Accurate FSD bubble density measurements are regularly obtained from the BNL Bubble Chamber Group 35 mm Mark I and 70 mm Mark II digitizers. The resulting savings of manual effort and computer time in three recent experiments were studied and are reported. Also, the role of density measurements in bubble chamber experiments is reviewed, and the history of FSD density measurements at BNL is discussed. Author (NSA)

N69-23561 California Univ., Berkeley.
THE SUCCESSIVE PRODUCTION OF A SERIES OF EXCITED STATES OF THE MERCURY ATOM
Walter Ludwig Borst (Ph.D. Thesis) 1968 95 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-13888

Mercury atoms were excited by electron impact in the energy region 4 to 18 eV using the retarding potential difference method. The total metastable excitation function with a tungsten target as detector was measured. The excitation function for the 6^3P_2 metastable state was obtained up to an energy of 8.5 eV. Slow inelastically scattered electrons produced near the thresholds of excitation were monitored, yielding supplementary information concerning the excitation. The slopes of the excitation cross sections

for the 6^3P_2 and 6^1P_1 states were measured assuming a linear threshold law. The maximum excitation cross section for the 6^3P_2 state was determined as 2.5×10^{-16} cm^2 ± 35% at an energy of 5.75 eV. The secondary electron yield for atoms in the 6^3P_2 state wa to was 2 to 5×10^{-4} depending on the state of the contaminated tungsten surface. Dissert. Abstr.

N69-23558# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
HIGH BURNUP PLUTONIUM OXIDE IRRADIATIONS
J. A. Christensen 1 Nov. 1968 3 p Presented at the ANS Winter Meeting, Washington, D.C., 11-15 Nov. 1968
(Contract AT(45-1)-1830)
(BNWL-SA-1969; Conf-681101-7) Avail: CFSTI

Bulk PuO_2 and Pu_2O_3 were irradiated to greater than 50% burnup in the MTR. Post irradiation examination consisted of metallography, audiography, and x-ray diffraction analysis. Results showed slight effects on crystal structure and the ability of the oxide to creep extensively at low temperature. The oxides reacted slightly with the Al cladding. No nonuniformities in Pu or fission fragment concentration were observed. NSA

N69-23568 Rutgers Univ., New Brunswick, N. J.
AN EXPERIMENTAL TEST OF DISTORTED WAVE THEORY
Lionel Steven Michelman (Ph.D. Thesis) 1968 206 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-14262

The Distorted Wave Born Approximation (DWBA) theory of direct interactions has been a widely accepted tool of nuclear spectroscopy. The polarization of protons from the ground state and second excited state (1.2 MeV) from the reaction $^{90}Zr(d,p)^{91}Zr$ was measured over the angular range of 40° to 130°, using 11 MeV deuterons. A series of DWBA calculations were made using optical model parameters obtained from elastic deuteron scattering cross section measurements on ^{90}Zr at 11 MeV and elastic proton scattering cross section and polarization measurements at 16.0 and 14.8 MeV, which corresponded to emergence energies of the (d,p) protons from the ground and second excited states, respectively. Elastic proton scattering cross section measurements which were made over the energy range of 14.4–16.4 MeV at 130°, 150° and 170°, turned out to have a smooth variation with energy, indicating that the DWBA direct reaction theory should have been appropriate. Dissert. Abstr.

N69-23578# California Univ., Berkeley. Lawrence Radiation Lab.
DAPR: VERTEX SEARCH AND TRACK MATCH
Dennis Hall Oct. 1968 8 p Presented at Intern. Conf. on Advan. Data Process. for Bubble and Spark Chambers, Argonne, Ill.
(Contract W-7405-eng-48)
(UCRL-18544; Conf-681025-4) Avail: CFSTI

A brief description of the vertex finding and track matching procedures used by the DAPR program is given. Vertex searching is accomplished by finding in each view all clusters of tracks whose ends are near the common intersection point of their descriptive circles. These view-vertices are spatially matched to associate clusters in the three views. Tracks of spatially matched clusters are compared to produce for each track in space the list of corresponding image tracks in each view. The algorithms used stress speed of decision. The comparison between views is a powerful tool used to clean up ambiguities unresolvable in individual views. Experience in use has demonstrated the speed and validity of the procedures used. Some additional degree of sophistication in the decision logic gives great promise of achieving results fully as good as the most careful manual scanning procedures. Author (NSA)

N69-23579 Duke Univ., Durham, N. C.
THE C13(He3, ALPHA) C12 REACTION AND THE STRUCTURE OF O16
Henry Richard Weller (Ph.D. Thesis) 1968 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-14337

The angular distributions of the outgoing alpha particles have been measured from the $C^{13}(He^3, \alpha)C^{12}$ reaction in 100 keV steps from 5.1 to 8.4 MeV for the ground and first two excited state alpha groups. Elastic angular distributions resulting from the scattering of He^3 by C^{13} and C^{12} were measured at He^3 energies of 6.0, 7.0, and 8.0 MeV. Excitation curves of the alpha particles, protons and He^3 ions resulting from the bombardment of C^{13} with He^3 were measured at various angles. Using the formalism of Blatt and Biedenharn and other considerations, we were able to make a probable spin assignment of $J^\pi = 3^-$ to a state in O^{16} at 27.6 MeV. This result also indicates a compound nucleus interpretation of j dependence for our data.

N69-23583 Colorado Univ., Boulder.
SELECTED TOPICS IN THE THEORY OF ATOMIC SPECTRA
Halis Odabasi (Ph.D. Thesis) 1968 574 p
Avail: Univ. Microfilms: HC $25.90/Microfilm $7.30 Order No. 68-14394

A brief background in time-independent perturbation theory, quantum theory of complex atoms, line strength and variation principle is introduced. The numerical procedure is outlined. The theoretical ionization potentials, term and level energies in SLJM and intermediate coupling scheme, for the five lowest lying configurations of Silicon, Phosphorus and Sulfur isoelectronic sequences are calculated by using non-relativistic Hartree-Fock-Slater basis sets. In the process of evaluation different interactions are added one at a time to give an idea about their effects. At each step the theoretical results are compared with the observed ones. To exhibit the mixing of terms or levels for typical cases the mixing coefficients, as defined in the text, are tabulated. Dissert. Abstr.

N69-23605 Colorado Univ., Boulder.
THE STARK EFFECT IN THE HYPERFINE STRUCTURE OF TL203 AND TL205
Harold Gilbert Palmer (Ph.D. Thesis) 1968 205 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-14395

The atomic beam magnetic resonance method has been used to measure the Stark shift for the ($F = 0$, $M_F = 0$) ($F = 1$, $M_F = 0$) transition in the $6^2P1/2$-electronic ground state of 30 percent abundant Tl^{205} and 70 percent abundant Tl^{203}. A newly constructed atomic beam machine was used for this measurement. Observations were made at several voltages corresponding to dc electric fields up to 1.1×10^3 volts/centimeter, which were applied between parallel plates in a magnetically shielded four-wire-type C field. The Stark shifts for the two isotopes include corrections for asymmetry due to the fact that the energy levels of the atom differ in the two transition region from their values in the electric field region. Both theoretical and experimental corrections were obtained, which agreed to within their calculated errors. The theoretical correction included consideration of the effects of lower and upper cutoffs of an assumed Maxwellian beam velocity distribution. Dissert. Abstr.

N69-23608 Stanford Univ., Calif.
MOMENTUM AND ENERGY SLIP IN RAREFIED GASES
Sudarsham Kumar Loyalka (Ph.D. Thesis) 1968 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-11319

In this dissertation the momentum and temperature slip problems have been studied by the use of a number of models. The models are constructed such that the most important properties of the linearized Boltzmann equation, i.e., the variable collision frequency, the correct Chapman-Enskog solution and the correct Prandtl number are preserved. The slip flow problems have been formulated for any molecular force law. Three different methods of solving the momentum slip flow problem are described in detail. First, it is shown that by using the method of elementary solutions an exact expression for the slip coefficient can be obtained for the variable collision frequency model with a one term degenerate kernel. Then the method of elementary solutions on the full range is utilized to solve the slip flow problem for the constant collision frequency models. Finally, a variational technique is used to treat the unmodelled Boltzmann equation and the slip coefficient is expressed in terms of the stationary value of a functional. Dissert. Abstr.

N69-23627# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.

ON THE PROPERTIES OF SOME ISOTOPES OF ELEMENTS 102 AND 103 [O SVOISTVAKH NEKOTORYKH IZOTOPOV 102-GO I 103-GO ELEMENTOV]

G. N. Flerov, G. N. Akapev, A. G. Demin, V. A. Druin, Yu. V. Lobanov et al. 1967 20 p refs In RUSSIAN

(JINR-P7-3556) Avail: AEC Depository Libraries

In the reactions ^{238}U (^{22}Ne,5n)$^{255}102$ and ^{239}Pu(^{18}O,5n)$^{252}102$, the α-decay properties of $^{255}102$ (E_α = 8.08 ± 0.03 MeV; $T_{1/2}$ = 3.0 ± 0.2 min) and $^{252}102$ (E_α = 8.41 ± 0.03 MeV; $T_{1/2}$ = 3 sec) isotopes are studied. The data on the spontaneous fission of the ^{238}U + ^{18}O reaction products are given. According to Ghiorso et al., the partial spontaneous fission half-life of $^{252}102$ should be considered only as a lower limit. The data on the properties of $^{256}103$ (E_α = 8.35 - 8.55 MeV; $T_{1/2}$ = 0.4 min) are presented. Author (NSA)

N69-23638# Rochester Univ., N. Y. Nuclear Structure Research Lab.

ECONOMIC ASPECTS OF COMPUTER SYSTEMS IN EXPERIMENTAL NUCLEAR PHYSICS

H. W. Fulbright Mar. 1969 26 p

(UR-NSRL-11) Avail: Issuing Activity

A review is given which emphasizes the economic aspects of data acquisition systems used in low and medium energy physics. A simple analysis is presented of the expenditures for on-line computing in a total of 36 different laboratories. Trends visible in, or suggested by, the analysis are discussed, along with some remarks about the support of on-line computing facilities in nuclear physics research laboratories. Author

N69-23670 Duke Univ., Durham, N. C.

AN ANGULAR-CORRELATION STUDY OF THE Mg 24 (He, $\alpha\gamma$) Mg 23 REACTION

Larry Carroll Haun (Ph.D. Thesis) 1968 205 p

Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-14332

Nine excited states of ^{23}Mg have been investigated with the ^{24}Mg (^3He, $\alpha\gamma$)^{23}Mg reaction at ^3He bombarding energies of 6.37 and 8.05 MeV using the angular-correlation method of axial symmetry. The observed α particles were detected in an annular semiconductor counter positioned at 180° relative to the beam direction. From the analysis of the experimental angular correlations, and in conjunction with known l_n values for ^{23}Mg, spin and parity assignments of $5/2^+$, $7/2^{(+)}$(3/2), $1/2^+$, $9/2^{(+)}$ (5/2), $1/2^-$ (3/2$^-$), $3/2^-$, (5/2$^+$), and $1/2^+$ were established for the levels at 0.45, 2.048, 2.356, 2.712, 2.768, 3.792, 3.98, and 4.353 MeV, respectively. Gamma-ray branching ratios were determined for each of these levels as were the γ-ray multipole mixing ratios for most of the transitions. Dissert. Abstr.

N69-23685 Michigan Univ., Ann Arbor.

MAGNETIC INTERACTIONS FOR CONFIGURATION d^5 IN WEAK CUBIC FIELD MATRICES FOR CONFIGURATIONS d^4, d^5, AND d^6s

Wai-Kee Li (Ph.D. Thesis) 1968 134 p

Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-13350

Magnetic interactions for the d^5 configuration have been calculated employing Racah's formulation of the theory of angular momentum. The magnetic interactions considered are spin-same-orbit, spin-other-orbit, and spin-spin interactions. Employing Racah algebra, general formulas for calculating matrix elements of a weak crystalline field for configurations d^n and $d^n s$ have been derived. Applying these formulas, the matrix elements for d^4, d^5, and d^4s including spin-orbit interaction have been calculated and tabulated. Dissert. Abstr.

N69-23688# Commissariat a l'Energia Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.

FISSION DAMAGE IN α-URANIUM AT 4°K

Jean Leteurtre [1968] 14 p refs Presented at the Intern. Conf. on Vacancies and Interstitials in Metals, Juelich, Ger., Sep. 1968

(CEA-Conf-1108; Conf-680910-5) Avail: AEC Depository Libraries

Samples irradiated at several burnups were examined. In order to explain micrographic results, and information about radiation damage in α-uranium, a coherent model was proposed for the fission particle effects. The number of point defects created by one initial fission is determined for pure and annealed metal. The importance of the self-anneal which occurs immediately in each displacement spike, and the anneal due to a new fission on the damage resulting from a previous fission, are estimated. Author (NSA)

N69-23696# Joint Inst. For Nuclear Research, Dubna (USSR). Lab. of High Energy.

ON A POSSIBILITY OF EXPERIMENTAL SEPARATION OF DIRECT EMISSION PROCESSES AND BREMSSTRAHLUNG OF GAMMA-QUANTUM K POSITIVE-MESON RADIATIVE DECAYS [ISSLEDOVANIE VOZMOZHNOSTI EKSPERIMENTAL'NOGO RAZDELENIYA PROTESSOV PRYAMOI EMISSII I TORMOZNOGO IZLUCHENIYA GAMMA-KVANTOV V RADIATSIONNYKH RASPADAKH K POLITIVE-MEZONOV]

V. S. Vanyashin, E. Fontenay-aux-Roses (France), G. D. Pestova, Z. V. Solodovnikova, N. G. Fadeev et al. 1967 16 p refs In RUSSIAN

(JINR-P1-3594) Avail: AEC Depository Libraries

A possibility of experimental separation of the direct emission processes and the bremsstrahlung of γ-quants in the K^+-meson radiative decays is investigated. It is shown that at certain characteristics of the direct emission processes it can be separated experimentally from the bremsstrahlung in an arbitrary infinite detector. Author (NSA)

N69-23709 Ohio Univ., Athens.

POLARIZATION OF THE NEUTRONS PRODUCED IN THE D(d,n) HELIUM 3 REACTION AT LOW DEUTERON BOMBARDING ENERGIES

Walter Gene Stoppenhagen (Ph.D. Thesis) 1968 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-14902

The results of Hänsgen *et al* show a marked resonance-like peaking in the neutron polarization at an average deuteron energy of 80 keV and having a width of 30-40 keV. In contrast, the results of Behof *et al*., indicate that the polarization is a slowly varying function of energy from 60 to 400 keV. Both sets of data differ considerably from the values predicted by Blin Stoyle. Because of the important theoretical interest of Hänsgen's result and because of the practical value of this reaction as a source of polarized neutrons for users of low energy accelerators, the neutron polarization is remeasured in the region from 80 to 120 keV incident energy. The polarization of the neutrons emitted at 50° in the laboratory system from a titanium deuteride target was measured. The polarization was inferred from measurements of the right–left asymmetry induced in elastic scattering from carbon.
Dissert. Abstr.

N69-23712 Rutgers Univ., New Brunswick, N. J.
ISOSPIN-FORBIDDEN COMPOUND-NUCLEAR RESONANCES IN Al 25 AND P 29
Bernard Teitelman (Ph.D. Thesis) 1968 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-14273

The analogs of the ground state and first-excited state of ^{25}Na and ^{29}Al were studied as compound resonances in ^{25}Al and ^{29}P, respectively, formed by scattering protons from ^{24}Mg and ^{28}Si targets. Positions of these resonances, observed in the elastic and inelastic channels, were in excellent agreement with their locations available from delayed-proton, (p,t), and (p,γ) experiments, and the uncertainties in the excitation energies were reduced to ± 6 keV. Assuming charge independence for the specifically nuclear interactions, it was therefore possible to accurately calculate Coulomb energy differences between the members of these isospin quartets with mass numbers 25 and 29 and to predict the masses of ^{25}Si and ^{29}S using an isobaric multiplet mass formula. An interpretation of the reduced widths of the isospin-forbidden resonances is offered in terms of isospin mixing introduced through the Coulomb interaction.
Dissert. Abstr.

N69-23722 California Univ., Berkeley.
ENERGY LEVEL CALCULATIONS FOR SINGLY IONIZED HAFNIUM
Rolf Joachim Mehlhorn (Ph.D. Thesis) 1968 157 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-13937

The parametric theory of atomic structure was used to derive formulas for matrix elements, including those of configuration interaction not hitherto available in the literature. These formulas were incorporated into a series of computer codes for calculating matrix elements, energy levels, g-values, and intensities. With the aid of these programs an analysis of Hf II was conducted. The odd parity levels could be described with a mean error of about 0.5% of the configuration width. However, many calculated g-values did not agree with the observations. Therefore, a new least squares fit, utilizing both the g-values and the energy levels was developed. With this fit the mean error for the g-values was reduced from 0.100 to 0.023, but the error in energies rose to 453 cm^{-1} for 82 energies.
Dissert. Abstr.

N69-23728 Rutgers Univ., New Brunswick, N. J.
THE PROTON-NEUTRON FINAL-STATE INTERACTION
Douglas P. Boyd (Ph.D. Thesis) 1968 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-14241

The reactions of pid,2pn and dip,2pn were studied at a proton bombarding energy of 16.0 MeV and deuteron bombarding energies of 16.0 MeV and 10.MeV. Two protons were detected in coincidence using solid-state detectors at angles which enhance the p-n final-state interaction. The coincidence resolving time was sharpened by using time-energy correlation techniques which utilize an on-line computer. The data were analyzed using the data-simulation technique. A simple theory which contained three adjustable parameters was found to produce satisfactory fits. In this theory the final-state interactions are accounted for by assuming additive enhancements for each pair of final-state particles and each spin state. The primary interaction is approximated by the sum of a constant amplitude plus the spectator effect amplitude. The widths of the final-state interaction peaks are in good agreement with Watson theory using the known p-n scattering length.
Dissert. Abstr.

N69-23728 Colorado Univ., Boulder.
RESONANCE PRODUCTION IN NEGATIVE KAON PROTON YIELDS NEGATIVE KAON PROTON NEGATIVE PION POSITIVE PION NEAR 5.0 GeV/c
Ernest Michael Urvater (Ph.D. Thesis) 1968 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-14404

The reaction $K^- p \rightarrow K^- p \pi^- \pi^+$ is studied in 50,000 pictures taken at the Brookhaven National Laboratory 80" liquid hydrogen bubble chamber exposed to incoming kaon beams of 5.0 and 4.6 GeV/c momenta. Seven well established and three or four unconfirmed resonant states are observed in the quasi-two and quasi-three body final states. The assumption is made, consistent with the observed production characteristics of the dominant resonant states [$K^*(890)$ and $N^{*++}(1236)$], that the final state under consideration is produced principally by two noninterfering one-pion-exchange (OPE) processes. The two diagrams corresponding to these two processes are calculated under the assumption that the virtual pion scatters quasi-elastically at each vertex of each diagram as if it were on the mass shell. The model calculation is evaluated by a Monte Carlo integration program and the detailed results are compared to the data with excellent overall agreement.
Dissert. Abstr.

N69-23743# Colorado Univ., Boulder.
POSITION OPERATORS OF QUANTUM SYSTEMS DESCRIBED BY FINITE AND INFINITE DIMENSIONAL WAVE EQUATIONS
Shimon Malin (Ph. D. Thesis) 1968 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-14390

A new consistency requirement is introduced which shows that the definition of position operator uniquely determines an expression for the probability density. A definition of a position operator is, therefore, acceptable only if this uniquely determined expression is a fourth component of a four-vector which, moreover, satisfies together with the other three components a continuity equation. It is proved that the Dirac theory satisfies this requirement and that it is impossible to define consistently a position operator for a Klein-Gordon particle. Other quantum systems described by finite dimensional wave equations are discussed. A theory of a spin 0 particle which is a bound state of two Direc particles in the limit of weak binding is introduced, and the center of mass probability density and current are found to be, in general, different from the corresponding Klein-Gordon expressions. The properties of position operators of quantum systems described by infinite dimensional wave equations were also investigated.
Dissert. Abstr.

N69-23744 Rutgers Univ., New Brunswick, N. J.
PROTON SCATTERING FROM EVEN TIN, CADMIUM, AND TELLURIUM ISOTOPES
William Joseph Makofske (Ph.D. Thesis) 1968 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-14259

For each set of isotopes, the oscillatory structure of the elastic scattering angular distributions is systematically damped with increasing neutron number, and the entire pattern moves to smaller angles due to a size effect. The inelastic scattering leading to the first 2^+ and 3^- collective states for each set of isotopes generally exhibits a systematic decrease in magnitude with increasing A, although the angular distributions are quite similar for each type of state. This variation cannot be explained entirely in terms of the known decrease in collectivity of these states with increasing A. Interpreting the increased damping of the elastic cross sections with increasing A in terms of an increase in the surface imaginary part of the optical potential W_D, a coupled-channel analysis on ^{112}Sn and ^{124}Sn, using published electromagnetic β_2's, was able to reproduce the experimental results with a 20% variation in W_D. Dissert. Abstr.

N69-23745 Oregon State Univ., Corvallis.
THE DECAY OF Cu 61 AND Cu 59 AND ENERGY LEVELS OF Ni 61 AND Ni 59
Donald Arthur Walker (Ph.D. Thesis) 1968 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-14493

The decay of ^{61}Cu and ^{59}Cu produced by (d,n) reactions on natural nickel was investigated. Gamma ray energies and relative intensities were measured with a high resolution Ge(Li) spectrometer. The gamma-gamma coincidence spectrum of ^{61}Cu was studied with a Ge(Li)-NaI(Tl) system. From these data, decay schemes of ^{61}Cu and ^{59}Cu are constructed. Inferred log ft. values together with the results of previous studies are used to make spin and parity assignments for the levels of ^{61}Ni and ^{59}Ni. Some previously reported ambiguities in spin assignments were removed. The results of this study are compared with recent theoretical shell-model calculations. An efficiency curve is also given for a 2 cm^2 x 6 mm Ge(Li) detector as well as curves for escape peak yield. The half life of ^{61}Cu was measured as 3.32 ± 0.01 hours. Dissert. Abstr.

N69-23747# Rochester Univ., N. Y. Nuclear Structure Research Lab.
COLD TARGET TECHNIQUES
H. W. Fulbright Mar. 1969 5 p Sponsored by NSF
(UR-NSRL-13) Avail: Issuing Activity

Targets of $H_2{}^{18}O$ and $^{15}NH_3$ condensed on a thin gold substrate supported at its edge by a liquid nitrogen cooled frame are described. The frame is screwed to a small flange welded to the bottom of a stainless steel cold trap supported from the top of the scattering chamber. Vapors to be condensed are admitted slowly through a thin piece of tubing fitted with a cup at its end, which can be swung into position to cover the thin gold foil during the deposition process. In order to avoid introducing unwanted impurities along with the target vapors, a shroud was added which encloses the target almost completely. The beam enters through a hole about 6 mm in diameter and leaves through a slit about 6 mm high. The shroud is also useful in protecting a room temperature target from vapors. P.A.B.

N69-23753# California Univ., San Diego. Dept. of Physics.
APPLICATION OF FADDEEV EQUATIONS TO PROBLEMS WITH LOCAL POTENTIALS: THE (3 ALPHA) AND THE (e-H) SYSTEMS
David Y. Wong Apr. 1968 23 p refs Presented at the Conf. on Three-Particle Scattering in Quantum Mech., Coll. Station, Tex., 1968
(Contract AT(11-1)-Gen-10)
(UCSD-10-P-10-36; CONF-680429-2) Avail: CFSTI

The Faddeev equations are reduced to a set of coupled one-variable integral equations by using a Sturmian function expansion for the two-body T-Matrix with local potentials. It is shown that the ground state and the first excited state of the three-body system can be calculated quite accurately by keeping only a few terms in the Sturmian function expansion. Specific examples considered are: (1) a single attractive Yukawa potential for three identical spinless bosons, (2) the (e,e,p) system with pure Coulomb interaction and (3) the (3α) system using a phenomenological potential derived from the α-α scattering data. A perturbative method is suggested for treating the remainder of the Sturmian function expansion. The extension of the present method to the three-body continuum region is also discussed. Author (NSA)

N69-23757 Auburn Univ., Ala.
HADRON PRODUCTION IN NUCLEON-NUCLEON COLLISIONS NEAR 800 GeV
William Horton Lamb, Jr. (Ph.D. Thesis) 1968 69 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-14503

Five nuclear interactions of mean primary energy $E_p \sim$ 800 GeV found in an Ilford G-5 emulsion stack flown for 17 1/2 h at an altitude of 125,000 ft have been analyzed to identify the particles emitted in the backward c.m. cone. The interactions have been selected by a special method of scanning designed to eliminate bias toward high multiplicity events. Of the 13 charged secondaries, 8 were attributed to pions, 2 to kaons, 3 to protons, and 0 to hyperons. The average kinetic energy of the secondaries in the c.m. system is 3.0 GeV, the average inelasticity is 0.36, and the average transverse momentum is 0.048 GeV/c. The latter quantity is observed to decrease in the extreme emission angles. The results are compared to a field theoretic model proposed by Krisch. Dissert. Abstr.

N69-23759# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fizki.
SELECTION OF THE OPTIMUM METHOD OF IRRADIATING ISOTOPES [VYBOR OPTIMAL'NOGO REZHIMA OBLUCHENIYA IZOTOPOV]
T. S. Zaritskaya and A. P. Rudik 1967 14 p refs In RUSSIAN; ENGLISH summary
(ITEF-537) Avail: AEC Depository Libraries

Pontryagin's maximum principle was used to solve the problems of isotope irradiation processes. The maximum irradiation properties were analyzed, and necessary conditions were found for irradiation by the maximum neutron flux. The problem of neutron flux variations with time, determined by the classical variational principle, was studied. NSA

N69-23760# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR) Inst. Teoreticheskoi i Eksperimental'noi Fiziki.
REGARDING THE QUESTION OF Pid SCATTERING [K VOPROSU O Pid-RASSEYANII]
O. D. Dal'Karov 1967 11 p refs In RUSSIAN; ENGLISH summary
(ITEF-542) Avail: AEC Depository Libraries

For an initial π-meson kinetic energy T ~ 200 MeV, the contribution of square diagram with the virtual isobar Δ_{33} into the πd elastic scattering is calculated. Sufficient agreement of experimental and theoretical curves is obtained. Author (NSA)

N69-23761 Ohio Univ., Athens.
STRANGE PARTICLE PRODUCTION IN NEGATIVE PION-PROTON INTERACTIONS AT 7 GeV/c
Jen-Shu Hsieh (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-14893

The experiment was performed using the 80" bubble chamber. The film scanned for this investigation represented 0.43 μb. per event. Nearly 1700 events with two charged secondaries at the production vertex and having kinks (decays) and/or V-particles were measured. About 950 of these events could be fitted to the more than thirty different final states having associated strange particles. The data analysis was done by using the program TVGP for space reconstruction of each track and the program SQUAW for kinematic fitting of each event. Events were identified on the basis of both kinematic fitting and bubble density information. A study was made of the various resonances produced in the interactions. The angular distributions of the K*(890) and Y^*_1 (1385) in the overall center-of-mass system are strongly peaked in the forward and the backward directions. Angular distributions are consistent with the assumption that the interaction between the incoming pion and the target proton is peripheral in character, with a K or K* being the exchange particle. Dissert. Abstr.

N69-23762# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
THE EXCITED LEVELS OF ^{193}Ir
T. Badica, A. Gelberg, P. Kemeny, S. Salageanu, and R. Ion Mihai 1968 18 p refs
(IFA-N.S.-20) Avail: AEC Depository Libraries

The levels of ^{193}Ir, populated by the radioactive decay of ^{193}Os, were studied by means of Ge(Li) and scintillation detectors. Single and coincidence spectra, as well as angular correlations, were measured; a level scheme of ^{193}Ir is proposed. Author (NSA)

N69-23764# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
ELECTRONS, GAMMAS AND NEUTRAL PION, IN HEAVY LIQUID BUBBLE CHAMBERS
D. Morellet Apr. 1968 90 p refs
(LAL-1190) Avail: CFSTI

A basis is given for understanding how to measure, calculate, and use electronic trajectories and how to combine them in γ or π^0. Some related topics such as delta rays and radiation length determination are also briefly reviewed. NSA

N69-23798# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
KAON-KAON AND PION-KAON SCATTERING LENGTHS
L. Micu 1968 9 p
(JINR-E2-3793) Avail: CFSTI

An expression for the K-K low-energy scattering amplitude in accordance with the general requirements of the Bose statistics, crossing symmetry, and unitary spin conservation is proposed. The π–K scattering lengths are evaluated by taking into account the scalar meson contribution. Author (NSA)

N69-23800# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
THE CORRECTION OF AUTORADIOGRAPHIC IMAGES FOR BROADENING
D. H. Bradhurst and D. G. Walker Nov. 1968 7 p refs
(AAEC/TM484) Avail: CFSTI

Image broadening effects were analysed as related to development of a proton activation method for determining diffusion profiles of radioisotopes and to assist in interpretation of earlier results in which no consideration had been given to errors arising from this phenomena. It was found that satisfactory correction can be obtained using matrix methods. Author

N69-23841# Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.
YIELD OF K X-RAYS EMITTED FROM U238 FRAGMENTS
S. S. Kapoor, V. S. Ramamurthy, and R. Zeghloul 1968 21 p refs
(BARC-363) Avail: CFSTI

The yield of K X-rays from different fragment masses have been determined in the thermal neutron induced fission of U^{235}. The energies of the pairs of fragments were measured with two semi-conductor detectors placed on either side of a thin U^{235} foil. The K X-rays from the light and the heavy groups of fragments were separated by measuring the X-ray energies with a 1 mm NaI(Tl) crystal. The fragment mass distributions in coincidence with the light group of K X-rays, heavy group of K X-rays and the unbiased mass distributions were simultaneously recorded in different quarters of 1024 channel analyzer memory. From these distributions, after suitable corrections for the background, X-ray detection efficiencies and finite energy resolution effects, the number of X-rays as a function of fragment mass were determined. Author

N69-23854# Institute of Nuclear Research, Warsaw (Poland).
STUDY OF THE Li-6(d,p)-Li-7 REACTION INDUCED BY DEUTERONS OF LOW ENERGY [L'ETUDE DE REACTION Li-6(d,p)Li-7 INDUITE PAR LES DEUTERONS DE BASSES ENERGIES]
I. M. Turkiewicz, J. Turkiewicz, A. Turce, I. A. Cepurcenko, and B. Fryszczyn 1967 18 p In FRENCH
(INR-P-849/I/PL) Avail: CFSTI

The angular distributions of protons from the reactions ^{6}Li(d,p_0)^{7}Li and ^{6}Li(d,p_1)^{7}Li were measured at deuteron energies of 1.48, 1.80, 2.04, 2.27, 2.49, 2.66, and 2.84 MeV. The experimental distributions were compared with those predicted by the Butler stripping theory and the Dar diffraction theory. It was established that these theories do not conform with the experimental results. Author (NSA)

N69-23882# Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.
ENERGY-ANGLE CORRELATION OF LONG RANGE ALPHA PARTICLES EMITTED IN THERMAL NEUTRON FISSION OF U 236
D. M. Nadkarni 1968 17 p refs
(BARC-362) Avail: CFSTI

The energy spectra of long range alpha (LRA) particles emitted at 90° and 0° (or 180°) with respect to the direction of fission fragment motion have been measured in the case of thermal neutron induced fission of U^{235}. These energy spectra were measured simultaneously using semi-conductor detectors for detecting the long range alpha particles and fission fragments. Significant differences in the characteristics of these spectra have been observed. Using these data, the full width at half maximum (FWHM) of the alpha-fission fragment angular correlation has been computed for alpha particles of various energies, assuming the correlation function to be gaussian with its maximum value at 94°. The variation of the computed FWHM of the alpha-fission fragment angular-correlation with alpha particle energy shows features similar to those observed in the case of spontaneous fission of Cf^{252} by Fraenkel. The present work indicates that very high energy LRA ($E_\alpha > 28.5$ MeV) are emitted preferentially along the fragment direction. Author

N69-23866# California Univ., Livermore. Lawrence Radiation Lab.
AN INTEGRATED SYSTEM FOR PRODUCTION OF NEUTRONICS AND PHOTONICS CALCULATIONAL CONSTANTS. VOLUME 6: PHOTON CROSS SECTIONS 1 keV TO 100 MeV
Ernest F. Plechaty and John R. Terrall 22 Oct. 1968 191 p refs
(UCRL-50400-Vol-6) Avail: CFSTI

Photon cross sections from 1 keV to 100 MeV photon energy are tabulated for 87 elements ($Z \leq 94$). Author (NSA)

N69-23879# International Center for Theoretical Physics, Trieste (Italy).
NON-LINEAR REALIZATIONS. PART 1: THE ROLE OF GOLDSTONE BOSONS
Abdus Salam and J. Stradthee Dec. 1968 31 p refs Submitted for publication
(IC-68-105) Avail: CFSTI

A method, based upon analogies with the Wigner boost technique, is presented for setting up the non-linear realizations of any continuous symmetry group. It is argued that such realizations are relevant to and useful in the treatment of cases of spontaneous symmetry breakdown. Author (ESRO)

N69-23888# California Univ., Livermore. Lawrence Radiation Lab.
THEORETICAL AND EXPERIMENTAL RESULTS ON THE TRAPPING AND BEHAVIOR OF THE E-LAYER IN THE ASTRON
J. W. Beal, M. Brattachnaider, N. C. Christofilos, R. E. Hester, W. A. S. Lamb, W. A. Sherwood et al 20 Jun. 1968 19 p refs Submitted for publication
(Contract W-7405-eng-48)
(UCRL-70933; Conf-680805-9) Avail: CFSTI

The injection of 300A of 3.8–MeV electrons into the Astron solenoid resulted in the trapping of sufficient electrons to form an E layer with strong diamagnetic effect. Low-frequency stable precessional oscillations of the E layer were observed during the initial operation of the Astron facility. The field generated by an E layer of moderate thickness was calculated. The image currents, the positive field index, and the threshold value of the loading factor were calculated as a function of the tank wall and the E layer radius. The image currents provide a minimum-B field which tends to center the E layer about the axis of symmetry of the tank. Author (NSA)

N69-23944# Illinois Univ., Urbana.
AN UPPER LIMIT ON THE DECAY RATE OF K^0_L YIELDS PI POSITIVE PIONS–GAMMA
Roy Cannon Thatcher (Ph.D. Thesis) 1968 76 p refs
(Contract AT(11-1)-1195)
(COO-1195-113) Avail: CFSTI

In the film from a spark chamber experiment on K^0_L decays performed in the 28° beam line of the ZGS, a search for the decay mode $K^0_L \rightarrow \pi^+\pi^-\gamma$ was undertaken. The charged decay products were momentum analyzed in a magnet and identified in a set of range-shower chambers on the basis of their behavior there. The position of the gamma ray conversion point in these chambers was compared with the position predicted on the hypothesis of $K^0_L \rightarrow \pi^+\pi^-\gamma$. The result is compared with the predictions of various theoretical models. The possible connections to other decay processes and the feasibilities of CP invariance tests are discussed. Author (NSA)

N69-23947# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
EQUATIONS FOR DENSITY MATRIX OF SUBSYSTEMS WITH FINITE NUMBERS OF FREEDOM DEGREES
S. V. Peletminskii and E. G. Petrov 1968 11 p refs In RUSSIAN
(ITF-68-20) Avail: AEC Depository Libraries

Equations are derived for the density matrix of subsystems with a number of freedom degrees in the quantum case. Author (NSA)

N69-23950 Ohio State Univ., Columbus.
THE EFFECT OF INHOMOGENEITIES IN THE RADIO FREQUENCY MAGNETIC FIELD (H_1) ON THE MEASUREMENTS OF T_2 BY NUCLEAR MAGNETIC RESONANCE SPIN-ECHOES
Donald Eugene Lauffer (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-15344

The effect of inhomogeneities in the radio frequency magnetic field on the spin echo amplitudes, for both the Meiboom and Gill and the Carr and Purcell methods, was investigated for a number of echoes. Jensen's spin echo diagram was used to develop a computer program to calculate numerically the amplitudes of the Carr-Purcell echoes, and a relationship between the terms contributing to the Carr-Purcell echoes was developed and employed to determine the amplitudes of the Meiboom-Gill echoes. Although the amplitudes of the Meiboom-Gill spin echoes were reduced by the inhomogeneities in the radio frequency field, it was found that they were reduced approximately in proportion and that the method produced measured values of T_2 that were equal to the actual ones. The Carr-Purcell method, on the other hand, gave erroneous values for T_2 relaxation times when the root mean square value of the rf field inhomogeneity exceeded 3% of the rf field strength. Dissert. Abstr.

N69-23973# Florida State Univ., Tallahassee.
METASTABLE IONS IN THE BENDIX TIME-OF-FLIGHT
R. H. Johnson and F. Mooberry [1968] 3 p refs
(Contract AT(40-1)-2001)
(TID-24192) Avail: CFSTI

Two modifications were made to the Bendix mass spectrometer in order to make it suitable for the study of metastable ions. The first one allows the potential of the ion lens to be varied independently of the flight tube potential over the complete range from 0 to −2.8 kV. The second modification involves the addition of several new grids to the detector stack for varying the voltage of the stack from 0 to −2.8 kV. NSA

N69-23974# California Univ., Berkeley. Lawrence Radiation Lab.
DETECTION OF NMR BY NUCLEAR RADIATION
D. A. Shirley Jul. 1968 40 p Presented at the 15th AMPERE Colloq., Grenoble, Fr., 16–21 Sep. 1968
(Contract W-7405-eng-48)
(UCRL-18315) Avail: CFSTI

Progress has been made in the field of detection of NMR in radioactive nuclei through the angular distributions of decay products. Some of the features of such radiative detection of NMR (NMR/RD) are described. NMR/RD is contrasted with conventional NMR. A unified theoretical description of NMR/RD is given, and experimental results are discussed. NSA

N69-24036# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
DECAYWT: A PROGRAM FOR WEIGHTED RESPONSES TO DECAY AND ABSORPTION COUPLED NUCLEAR CHAINS
D. C. Sherman 17 Jul. 1968 21 p refs
(Contract W-31-109-eng-52)
(KAPL-M-6937) Avail: CFSTI

DECAYWT, a program for the CDC-6600 computer, will analyze the time behavior of one to three member coupled nuclear isotopic chains excited in response to a reactor power history. The results are summed with any assigned weighting factors to yield net effects such as reactivity or photoneutron source. The mathematical formulism is provided in the program. Selection of all units, chain parameters, coupling by neutron capture or by radioactive decay, and degree of coupling is left to the user. Each set of chains is limited to no more than 12 nuclides, however the power history can be recycled with new sets to produce accumulative effects due to any number of chains. Approximate running time is 0.0020 sec per nuclide per time increment. Input and output formats are shown; a sample problem is included. Author (NSA)

N69-24037# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
THE KAPL-76 EXPERIMENT TO DETERMINE FISSIONABLE CONTAMINATION AT ECF
E. W. Zeltmann and R. G. Gray 26 Apr 1968 37 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6910) Avail: CFSTI

Tests have been performed to determine whether fissionable contamination will be deposited on the coupons if TP-126 corrosion coupons are carefully handled in the Expended Core Facility, ECF. Sixteen Zircaloy coupons were involved in this experiment. Of all 16 tested, only one had any significant contamination above background. It is our belief that this coupon did not pick up this contamination from the ECF but rather from an Al spacer which was adjacent to it. It has been inferred that TP-126 corrosion coupons may be handled identically at ECF without becoming contaminated with fissionable material. Author (NSA)

N69-24045# California Inst. of Tech., Pasadena. Synchrotron Lab.
STATUS AND PERSPECTIVES OF PHOTOPRODUCTION EXPERIMENTS
Clemens A. Heusch Sep. 1968 155 p refs
(Contract AT(11-1)-68)
(CALT-68-171; CTSL-43) Avail: CFSTI

Three lectures are presented, which deal primarily with the photoproduction of single nonstrange pseudoscalar and vector mesons; data, problems, and current ideas toward their interpretation. NSA

N69-24061# Joint Inst. For Nuclear Research, Dubna (USSR).
ON THE PENETRABILITIES IN QUANTUM MECHANICS
Liviu Gr. Ixaru 1968 23 p refs
(JINR-E4-4111) Avail: AEC Depository Libraries

Different definitions for the penetrability are observed. After a brief review of these definitions the author obtains exact calculation formulas, as well as WKB approximate formulas for each definition in the case of a simple potential. Author (NSA)

N69-24075# Stanford Linear Accelerator Center, Calif.
TWO-BODY PHOTOPRODUCTION
B. Richter Sep. 1968 60 p refs Presented at 14th Intern. Conf. on High Energy Phys., Vienna, 28 Aug.–5 Sep. 1968 Sponsored by AEC
(SLAC-PUB-501) Avail: CFSTI

A summary is presented of high-energy photoproduction data from recent experiments at CEA, DESY, and SLAC. Data on the following are discussed and compared with theoretical models; charged single-pion photoproduction, π^0 photoproduction; photoproduction of $N^*(1238)$; and charged K-meson photoproduction. NSA

N69-24082# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
TRANSVERSE SPACE-CHARGE EFFECTS IN BUNCHED BEAMS IN A TRANSPORT SYSTEM
J. Claus 1 Aug. 1968 16 p refs
(BNL-13103; AADD-144) Avail: CFSTI

An analytical approach to the problem of space charge effects in the AGS based on the assumption of disregardably small coherent and incoherent energy errors and disregardably small longitudinal space charge forces is discussed. The bunches are assumed to be sufficiently long compared to their cross sections to calculate the space charge forces from cylindrical symmetry. Two possibilities are considered: a transport system without any focusing and one with a periodic focusing quadrupole system. NSA

N69-24101# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
MEDIUM ENERGY NUCLEAR PHYSICS WITH ELECTRON LINEAR ACCELERATORS. MIT 1967 SUMMER STUDY
W. Bertozzi, ed. and S. Kowalski, ed. 1967 489 p refs
(Contract AT(30-1)-2098; Grant NSF-70618)
(MIT-2098-470; TID-24667) Avail: CFSTI

CONTENTS:

1. MEDIUM ENERGY NUCLEAR PHYSICS WITH HIGH DUTY ELECTRON LINEAR ACCELERATORS W. Bertozzi p 1–14 refs

2. DESCRIPTION OF SOME ACCELERATOR FACILITIES p 15–90 refs (See N69-24102 12-11)

3. ELECTRON SCATTERING p 91–196 refs (See N69-24103 12-24)

4. PROCEEDINGS OF THE ROUND-TABLE DISCUSSION ON ELECTRON SCATTERING AT 180° p 197–216 refs (See N69-24104 12-24)

5. RADIATIVE CORRECTIONS p 217–268 refs (See N69-24105 12-24)

6. ELECTROMAGNETIC ASPECTS OF THE TWO-NUCLEON PROBLEM p 269–316 refs (See N69-24106 12-24)

7. CORRELATIONS BETWEEN NUCLEONS IN NUCLEI p 317–356 refs (See N69-24107 12-24)

8. SCATTERING OF HIGH ENERGY PROTONS (INCLUDING NUCLEON-NUCLEON CORRELATIONS) p 357–424 refs (See N69-24108 12-24)

9. COINCIDENCE EXPERIMENTS DEALING WITH SINGLE PARTICLE STATES AND CORRELATIONS p 425–483 refs (See N69-24109 12-24)

10. PHOTONS IN NUCLEAR PHYSICS p 483–520 refs (See N69-24110 12-24)

11. NUCLEON STUDIES: PION-PHOTOPRODUCTION; PION-ELECTROPRODUCTION; PION-SCATTERING; COMPTON EFFECT p 521–580 refs (See N69-24111 12-24)

12. PION AND MUON BEAMS FROM ELECTRON ACCELERATORS p 581–608 refs (See N69-24112 12-24)

13. PION AND MUON PHYSICS p 609–658 refs (See N69-24113 12-24)

N69-24103# Massachusetts Inst. of Tech., Cambridge.
ELECTRON SCATTERING
In its Medium Energy Nuclear Phys. with Electron Linear Accelerators 1967 p 91–196 refs (See N69-24101 12-24)
Avail: CFSTI

A survey is presented of the lines along which research on nuclear structure by electron scattering has proceeded. Formalisms for calculating the electron–nucleus interaction are outlined, together with corrections to raw scattering data. The information that can be obtained by elastic, inelastic, and quasi-elastic scattering experiments is discussed in terms of available results. NSA

N69-24104# Massachusetts Inst. of Tech., Cambridge.
PROCEEDINGS OF THE ROUND-TABLE DISCUSSION ON ELECTRON SCATTERING AT 180°
In its Medium Energy Nuclear Phys. With Electron Linear Accelerators 1967 p. 197–216 refs (See N69-24101 12-24)
Avail: CFSTI

Discussed were experimental problems associated with both elastic and inelastic electron scattering at 180°. A proposed magnet for the 900 spectrometer has been designed and used to deflect the beam horizontally on its original axis; some background noise due to electrons scattering on the pole faces of the ancilliary magnet was observed. Counting rate estimates were obtained for the nuclear magnetization distribution from bismuth 209. G.G.

N69-24105# Massachusetts Inst. of Tech., Cambridge.
RADIATIVE CORRECTIONS
In its Medium Energy Nuclear Phys. with Electron Linear Accelerators 1967 p 217–268 refs (See N69-24101 12-24)
Avail: CFSTI

Reviewed are various studies on electromagnetic radiative corrections for soft photon effects in high energy nuclear scattering. An example calculation on radiative correction to the first Born approximation cross section for inelastic scattering of high energy electrons is given and the line shape and radiative tail in the region of 10 MeV or less from the elastic peak are analyzed. Effects of radiative tails and corrections to inelastic scattering on nuclei at low excitation are compared for muons and electrons. G.G.

N69-24106# Massachusetts Inst. of Tech., Cambridge.
ELECTROMAGNETIC ASPECTS OF THE TWO-NUCLEON PROBLEM
In its Medium Energy Nuclear Phys. with Electron Linear Accelerators 1967 p 269–316 refs (See N69-24101 12-24)
Avail: CFSTI

Electromagnetic interactions and their interconnections with two proposed body forces are discussed for the nucleon-nucleon problem. The importance of relativistic effects in electron-deuteron scattering and their influence in extracting the neutron form factor are outlined. A detailed analysis of electron deuteron scattering is given and compared with experimental results on elastic and inelastic e-d scattering cross sections. Analysis of the muon scattering characteristics showed that muons had much smaller radiative corrections than electrons only when the muon energy and momentum transfer were low. G.G.

N69-24107# Massachusetts Inst. of Tech., Cambridge.
CORRELATIONS BETWEEN NUCLEONS IN NUCLEI
In its Medium Energy Nuclear Phys. with Electron Linear Accelerators 1967 p 317–356 refs (See N69-24101 12-24)
Avail: CFSTI

Secondary nucleon effects on the motion of one nucleon in a nucleus are discussed for various forms of correlations. Photon absorption sum rules and correlation effects are developed for the nuclear photoeffect at high energies. Emphasis is placed on the nature of the relative two-particle wave functions in nuclei and their effects on the interactions between nucleons in nuclei. G.G.

N69-24108# Massachusetts Inst. of Tech., Cambridge.
SCATTERING OF HIGH ENERGY PROTONS (INCLUDING NUCLEON-NUCLEON CORRELATIONS)
In its Medium Energy Nuclear Phys. with Electron Linear Accelerators 1967 p 357–424 refs (See N69-24101 12-24)
Avail: CFSTI

Analyzed are the following experiments: (1) scattering of 20 GeV energy protons from various light, medium, and heavy nuclei; (2) scattering of 1.7 Gev/c momentum protons from protons, deuterons, He^4, C^{12}, and O^{16}; and (3) elastic scattering of electrons from He with large momentum transfer. Harmonic oscillator wave functions with nucleon-nucleon correlations are used to interpret the results. G.G.

N69-24109# Massachusetts Inst. of Tech., Cambridge.
COINCIDENCE EXPERIMENTS DEALING WITH SINGLE PARTICLE STATES AND CORRELATIONS
In its Medium Energy Nuclear Phys. with Electron Linear Accelerators 1967 p 425–483 refs (See N69-24101 12-24)
Avail: CFSTI

Coincidence experiments on single particle correlations derive the harmonic oscillator parameters of the s and p shell from quasi-elastic scattering data. The results of some (p,d) experiments on the pick-up of neutrons in the inner shell are presented. Calculated are levels and transition rates of proton-electron interactions at various energies and their effects on the nucleus. G.G.

N69-24110# Massachusetts Inst. of Tech., Cambridge.
PHOTONS IN NUCLEAR PHYSICS
In its Medium Energy Nuclear Phys. with Electron Linear Accelerators 1967 p 483–520 refs (See N69-24101 12-24)
Avail: CFSTI

The photoproduction of pions from complex nuclei was studied by relating the transition matrix for the production of one pion from a nucleon to that from a nucleus by impulse approximation. Positron beams are proposed for the experimental production of monochromatic photons via positron annihilation in flight. G.G.

N69-24111# Massachusetts Inst. of Tech., Cambridge.
NUCLEON STUDIES: PION-PHOTOPRODUCTION: PION-ELECTROPRODUCTION: PION-SCATTERING: COMPTON EFFECT
In its Medium Energy Nuclear Phys. with Electron Linear Accelerators 1967 p 521–580 refs (See N69-24101 12-24)
Avail: CFSTI

Discussed are photo- and electro-pion productions from the nucleon and their absorption sensitivities to higher momentum aspects of nuclear scattering wavefunctions. Electroproduction at energies less than 500 MeV or 600 MeV is analyzed by five independent kinematic variables, and the form factors for proton and neutron. Compton scattering in the 500 MeV region is found at the one-pion resonance (at 90°) and in the region below and near the threshold. G.G.

N69-24112# Massachusetts Inst. of Tech., Cambridge.
PION AND MUON BEAMS FROM ELECTRON ACCELERATORS
In its Medium Energy Nuclear Phys. with Electron Linear Accelerators 1967 p 581–608 refs (See N69-24101 12-24)
Avail: CFSTI

Calculated yields of pions and muons from medium energy electron linear accelerators depend upon the measured photoproduction cross sections. Beryllium and carbon are the best candidates for pion production targets. The possibility of new accelerators linacs to produce stopped muons is evaluated from intensities of the linacs and photoproduction cross sections on target nuclei. An idealized solenoid for transporting low-energy pions and capture of the resultant decay muons is proposed. G.G.

N69-24113# Massachusetts Inst. of Tech., Cambridge.
PION AND MUON PHYSICS
In its Medium Energy Nuclear Phys. with Electron Linear Accelerators 1967 p 609–658 refs (See N69-24101 12-24)
Avail: CFSTI

A general survey of pion nuclear interactions is given and possible experimental implications are discussed. Data for the (π^+2p) reaction using ($\approx$80 MeV) pions show that the pion picks out a correlated nucleon pair, gives that pair its energy and removes it from the nucleus; the nucleus is left in one of the spectrum of parent two-hole states of the A particle system as predicted by theoretical models. Physical research with muons is used to probe electromagnetic properties of nuclei through μ-mesic x-ray studies and their polarization effects. The weak interaction of the muon is also used in probes of strong interactions and properties of nuclei. In complex nuclei, muon capture gives information on correlations as well as other characteristics. Muon scattering from nuclei provides a check on radiative corrections to electron scattering. G.G.

N69-24117# Gulf General Atomic, San Diego, Calif.
A SET OF EVALUATED NUCLEAR DATA FOR U^{233}
G. L. Boroughs, C. W. Craven, Jr., and M. K. Drake 27 Aug. 1968 65 p refs
(Contract AT(04-3)-167)
(GA-8854) Avail: CFSTI

A study was made of the neutron cross sections and associated nuclear data for ^{233}U. A set of data was prepared in the ENDF/B format and was sent to the Evaluation Center at Brookhaven National Laboratory. The data include resolved and unresolved resonance parameters for capture and fission at 0.0001 eV to 15 MeV; pointwise-in-energy elastic scattering cross sections from 0.0001 eV to 15 MeV; pointwise cross sections for the total and partial neutron cross sections from 100 keV to 15 MeV; angular distributions for elastically scattered neutrons; energy distributions for secondary neutrons from (n,n'), (n,2n), (n,3n), and (n,f) reactions; the number of neutrons produced per fission; and fission-product yields for thermal neutron fission. (NSA)

N69-24118# Gulf General Atomic, San Diego, Calif.
APPLICATION OF PHOTOINDUCED REACTIONS TO NUCLEAR MATERIALS SAFEGUARDS PROBLEMS Project Summary Report, 10 Nov. 1967–30 Jun. 1968
J. R. Beyster, R. L. Bramblett, R. O. Ginaviv, T. Gozani, C. P. Jupiter et al 29 Jul. 1968 48 p refs
(Contract AT(04-3)-167)
(GA-8812) Avail: CFSTI

Prompt and delayed neutron yields from photonuclear processes in ^{239}Pu, ^{235}U, and ^{238}U were measured. The decay of the neutron populations following irradiations of various lengths was also studied. Mass-yield curves and γ spectra of fission products were also investigated as possible nuclear signatures. The precision of assays based on an electron accelerator assay system was analyzed, as were attenuation effects in the irradiation of large samples. Computer programs were developed for calculating bremsstrahlung spectra and neutron yields from photofission. A scanner and detector system for bulk assays was fabricated, and an irradiation facility was constructed. NSA

N69-24120# Eidgenoessisches Institut fuer Reaktorforschung, Wuerenlingen (Switzerland).
NEUTRON THERMALIZATION IN HEAVY WATER: AN INVESTIGATION
P. Wydler Aug. 1968 82 p refs
(EIR-137) Avail: AEC Depository Libraries

To check different scattering models for heavy water, time-dependent and steady-state spectrum measurements were made. The time-dependent spectra were measured in the pure moderator using a pulsed source and a chopper. The steady-state spectra were observed in cadmium solutions at various distances from a source of fast neutrons provided by a reactor. The neutrons were analyzed by time of flight. Calculations based on diffusion and transport theory were made using the free gas model, the Nelkin-Honeck model, and the Haywood scattering kernel for D_2O. The kernels were found to predict quite different thermalization properties. Theoretical spectra based on the Haywood kernel agreed best with the experimental results. Author (NSA)

N69-24125# Brookhaven National Lab., Upton, N. Y.
NEUTRON RESONANCE CAPTURE γ RAYS
R. E. Chrien Oct. 1968 31 p Presented at Am. Phys. Soc. N. Y. State Sect. Meeting, Albany, 4–5 Oct. 1968
(BNL-12965; Conf-681024-1) Avail: CFSTI

The information that γ spectroscopy provides concerning the capturing and final states in the neutron capture process is discussed following a summary of the features of the capture process and the various types of capture experiments. NSA

N69-24127# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
CLEM: A LEGENDRE POLYNOMIAL FITTING PROGRAM WITH A NON-NEGATIVITY CONSTRAINT
C. J. Slavik, C. R. Lubitz, J. T. Reynolds 22 May 1968 17 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6923 (CRL-5)) Avail: CFSTI

A program which generates constrained Legendre moments for neutron scattering angular distributions is described. The constraint referred to is that the angular distribution itself should be non-negative. This minimizes the problem of negative angular distributions which some design programs are unable to handle. Author (NSA)

N69-24141# California Univ., Livermore. Lawrence Radiation Lab.
CORRELATION MEASUREMENTS OF CIRCULARLY-POLARIZED GAMMA RAYS FOLLOWING BETA DECAY OF Co^{56} AND Mn^{52}
Jerry A. Sawyer Jun. 1968 196 p refs
(UCRL-50440) Avail: CFSTI

Circular polarization of the gamma rays was measured by observing the change in the beta-gamma coincidence rate resulting from the dependence of the photon-electron scattering cross section on the relative orientation of the photon and electron spins. Approximately 7.9% of the electrons were polarized in magnetized iron, the medium in which photon-electron scattering occurs. The correlation measurement yielded an asymmetry parameter,

designated as A, which depends upon the states involved and their nuclear properties. The nuclear properties were expressed quantitatively as the matrix elements (Fermi, Gamow-Teller, charge dependent) of the beta-interaction operators and as the electromagnetic multipole operators between the states involved in the beta-gamma cascade. Because the matrix elements also were a function of the spins of the states involved, measurements were made to determine the spin, as in the ^{55}Co measurement. Author (NSA)

N69-24142# Bettis Atomic Power Lab., Pittsburgh, Pa.
INTEGRAL MEASUREMENTS OF NEUTRON CAPTURE AND FISSION IN U^{233} (LWBR DEVELOPMENT PROGRAM)
S. B. Gunst, D. E. Conway, and D. R. Harris Aug. 1968 24 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-760) Avail: CFSTI

Reviews of available data for ^{233}U show that the recommended 2200 m/sec values of parameters have not changed very much in recent years, but the uncertainties have decreased significantly. Nevertheless, the need for additional work at thermal energies is pointed out, especially for thermal capture and the thermal alpha, the capture-to-fission cross-section ratio. A review of ^{233}U epithermal integral measurements reported by seven groups of experimenters throughout the world gives a conditioned set in which the capture integral for the energy range from 0.5 eV to infinity is 137 ± 6 barns, the fission integral is 779 ± 25 barns, and the epithermal alpha is 0.176 ± 0.005. Author (NSA)

N69-24144# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
EXPERIMENTAL STUDY OF THE SLOWING DOWN OF FAST NEUTRONS IN THIN PLATES OF HYDROGENATED MATTER
Rodolphe Bayer Jun. 1968 32 p refs In FRENCH
(CEA-R-3489) Avail: AEC Depository Libraries

The slowing down time of fast neutrons in slabs of hydrogenated matter with finite sizes was measured by two methods: a direct measurement of the delay between the time the fast neutrons enter the moderator and the time the slow neutrons leave it; and an indirect measurement in which a narrow resonance is studied with moderated neutrons whose time distribution is deduced from the apparent width of the resonance. This latter method uses neutrons produced by a linear accelerator and a moderator with a low hydrogen content in order to increase the widening of the resonance. The experimental results were compared with a Monte Carlo calculation on a moderator with infinite lateral sizes. The agreement is satisfactory. Author (NSA)

N69-24146# Oak Ridge National Lab., Tenn.
A STUDY OF THE B^{11}(He^3,p) C^{13} AND B^{11} (He^3, He^3) B^{11} REACTIONS
H. L. Adair Jan. 1969 73 p refs
(Contract W-7405-ENG-26)
(ORNL-4339) Avail: CFSTI

The proton angular distributions were analyzed in terms of the plane-wave stripping theory of Newns, and the optical model was used to fit the elastic scattering data. All the experimental measurements were made with the 5.5-MeV Van de Graaff. The reaction products were observed with silicon surface-barrier detectors. A particle identification system, which identifies the type and energy of the incident particle, was used to facilitate the interpretation of the pulse-height spectra. Proton angular distributions, corresponding to the ground and first excited states of ^{13}C for an incident ^{3}He energy of 12 MeV and for the ground, first, second, sixth, eighth, ninth, and thirteenth excited states of ^{13}C for an incident ^{3}He energy of 10 MeV, were obtained. Spin and parity assignments were made for the eighth and thirteenth excited states of ^{13}C for which no values were reported. Author (NSA)

N69-24174# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
NEUTRON RESONANCES OF Ga-69 AND Ga-71 ISOTOPES
H. Malecki, L. B. Pikelner, I. M. Salamatin, and E. I. Sharapov 1968 14 p refs In RUSSIAN
(JINR-P3-4152) Avail: AEC Depository Libraries

Radiative capture, self-indication and transmission measurements were performed on enriched ^{69}Ga and ^{71}Ga isotopes by the time-of-flight method using the pulsed reactor IBR with a microtron. The parameters of the isolated resonances were obtained in the energy range up to 5 keV. For 18 resonances of both isotopes, spins J were determined. The obtained values of the strength functions $S_0(J)$ agree for two spin states with the statistical errors. Author (NSA)

N69-24175# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
MUON CAPTURE BY COMPLEX NUCLEI
R. A. Eramzhyan 1968 29 p refs Presented at the Conf. on Electron Capture and Higher Order Processes in Nucl. Decays, Debrecen, Hungary, 15–18 Jul. 1968
(JINR-E4-4092) Avail: AEC Depository Libraries

The value of the muon-nucleon coupling constants derived from muon capture data on hydrogen and light nuclei as well as the problem of the neutron spectrum and angular distribution is discussed. The collective aspects of the giant resonance states are considered. Author (NSA)

N69-24179# Colorado Univ., Boulder, Colo. Nuclear Physics Lab.
[NUCLEAR PHYSICS] Technical Progress Report, 1 Nov. 1967–1 Nov. 1968
1 Nov. 1968 101 p refs
(Contract AT(11-1)-535)
(COO-535-591) Avail: CFSTI

The experimental research program dealt primarily with the reactions and scattering of protons, deuterons, and ^{4}He on medium-weight and heavy nuclei. Information on the energy levels of a number of nuclei was extracted. The theoretical research program dealt with composite particle scattering theory. Coulomb energies of A = 20 to 42 nuclei, the behavior of collective-model parameters under band splitting, and the asymmetry observed in the line shape of several isobaric analog resonances. Improvements to the cyclotron facility are reported, as are developments in semi-conductor detectors, neutron time-of-flight spectrometers, diffraction spectrometers, isotope separators, conversion electron spectroscopy, reaction product spectrometers, beta spectrometers, and associated electronic equipment. Author (NSA)

N69-24185# California Univ., Berkeley. Lawrence Radiation Lab.
TABLES OF STRUCTURE AMPLITUDES FOR (ALPHA, d) REACTIONS
Norman K. Glendenning Aug. 1968 72 p
(Contract W-7405-ENG-48)
(UCRL-18270) Avail: CFSTI

Tables of structure amplitudes for (α,d) reactions, useful in the analysis of two-nucleon transfer reactions, are given. NSA

N69-24187# United Kingdom Atomic Energy Authority, Harwell (England). Reactor Group.
STUDIES OF THE LIQUID STATE USING THE INELASTIC SCATTERING OF SLOW NEUTRONS

Stanley John Cocking (Ph.D. Thesis—London Univ., Nov. 1967) Aug. 1968 137 p refs
(AERE-R-5867) Avail: CFSTI; UK 19s

The atomic motions of monatomic liquids, mainly liquid sodium and liquid lead, were studied by observing the spectra of initially monokinetic neutrons after scattering by thin specimens of the liquids. The incident neutrons, with wavelength of 4 Å (or longer), were selected from a reactor beam using a mechanical chopper; and the scattered spectra were analyzed at six different scatter angles by the time-of-flight method. Both incoherent and coherent scattering, which provide information on single-particle and collective motions, respectively, were studied. The basic formalism relating atomic motions to the observed spectra is outlined and developed separately for these two aspects of the motions. Author (NSA)

N69-24205# Forskningradens Lab., Studsvik (Sweden).
PRECISION MEASUREMENTS IN THE DECAY OF Sn-113
B. Fogelberg and A. Baecklin 1968 7 p
(NP-17722; LF-23) Avail: AEC Depository Libraries

Energies and intensities of γ-rays and conversion electrons following the decay of ^{113}Sn were measured with Ge(Li) diodes and a double-focusing β spectrometer, respectively. No trace of a 647-keV crossover transition was found. Author (NSA)

N69-24208*# Maryland Univ., College Park. The Inst. for Fluid Dynamics and Applied Mathematics.
SINGLE-ELECTRON CAPTURE BY MULTIPLY-CHARGED CARBON IONS AT ENERGIES BELOW 40 KeV
H. Jay Zwally Dec. 1968 171 p refs
(Grants NGR-21-002-006; NSF-GP-8325)
(NASA-CR-100752; BN-582) Avail: CFSTI

Total cross sections for single-electron capture by C^{4+} from the target gases of He, Ne, and Ar were measured at laboratory energies below 40 kev. The relative velocities of collision were in the near adiabatic range of $1 - 8 \times 10^7$ cm/sec. Cross sections were measured for C^{2+} on He, Ne, Ar, and Kr^{3+} on He. The experimental method was to pass an ion beam through a thin gas target under single collision conditions and to separate and measure the fast collision products according to their charge state. The results are interpreted in terms of the pseudo-crossing of the adiabatic potential energy curves for the initial and the final states. A comparison is made with a cross-section function, derived from the limited Landau-Zener theory, using an empirical value of the interaction matrix element that is based on previous theoretical and experimental results. Author

N69-24214# Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'Noi Fiziki.
PHENOMENOLOGICAL THEORY OF ANALOG RESONANCES [K FENOMENOLOGICHESKOI TEORII ANALOGOVYKH REZONANSOV]
I. S. Shapiro 1968 24 p refs In RUSSIAN; ENGLISH Summary
(ITEF-625) Avail: AEC Depository Libraries

It is shown that the resonance rescattering in the initial and final channels gives rise to the fine structure of analogue resonances. By means of an approximation to the unitary condition, formulas are derived which describe the energy behavior of the cross section and the connection between partial and total widths. The results obtained are valid in the region of non-overlapping levels of the compound nucleus. Author (NSA)

N69-24215# Pittsburgh Univ., Pa.
ON THE COVARIANCE AND ANALYTICITY OF SCATTERING AMPLITUDES
R. Seiler Oct. 1968 35 p refs
(Contract AT(30-1)-3829)
(NYO-3829-26) Avail: CFSTI

The problem of analytic extensions of real analytic functions into complex domain, invariant under the action of complex Lorentz transformations with determinant one, is analyzed for the discussion of crossing and CPT symmetries in the S-matrix approach to scattering. The first lecture deals with geometries in a linear space and the corresponding symmetry groups. The second lecture contains a brief survey of the representation theory of the real Lorentz group. Restrictions and extensions of spinor representations are considered. The last lecture starts with an exposition of the CPT theorem in field theory. Only the parts necessary for the comparison with the analog problem in analytic S-matrix theory are considered. Finally, the analytic extensions of real analytic scattering amplitudes are analyzed. NSA

N69-24216# Australian National Univ., Canberra. Research School of Physical Sciences.
NUCLEAR REACTION THEORIES: LECTURES BY A. M. LANE
G. J. Clark and G. W. Kerr 6 Apr. 1967 185 p
(ANU-P-382) Avail: AEC Depository Libraries

A series of lectures dealing with nuclear reaction theories are presented. S-matrix, R-matrix, and various modified-Hamiltonian theories are discussed in detail. NSA

N69-24226# Commitato Nazionale per l'Energia Nucleare, Frascati (Italy).
ON THE APPARATUS FOR AN EXPERIMENT OF TWO π^0 PHOTOPRODUCTION IN HYDROGEN WITH A HEAVY LIQUID BUBBLE CHAMBER. PART 1: THE HYDROGEN TARGET
S. De Schryver, L. Fiore (Rome Univ.), E. Lodi-Rizzini (Pavia Univ.), G. C. Mantovani (Pavia Univ.), I. Modena et al 20 Nov. 1968 8 p refs *Its* Nota Interna No. 419
(LNF-68/70) Avail: CFSTI

The construction of a hydrogen target to be inserted in a freon bubble chamber is described. The problems posed by the use of a photon beam are discussed. The best solution seems to be a thin-walled gaseous target at high pressure placed in a small region near the chamber center. The results of a Monte Carlo efficiency calculation are also reported. The apparatus will be used at the Frascati Electronsynchrotron to investigate the double π^0 photoproduction on protons. Author

N69-24229# California Univ., Berkeley. Lawrence Radiation Lab.
FOUR-BODY STRANGE PARTICLE PRODUCTION IN pp COLLISIONS AT 6 GeV/c
Stanley Lewis Klein (Ph.D. Thesis) Sep. 1968 120 p refs
(Contract W-7405-eng-48)
(UCRL-18306) Avail: CFSTI

An exposure of the LRL 72-in. liquid-hydrogen bubble chamber to 6 GeV/c protons has yielded some 3000 examples of production of strange particles in four-body final states. Cross sections for the reactions $pp \rightarrow \Lambda K^0 p\pi^+$, $pp \rightarrow \Lambda K^+ p\pi^0$, and $pp \rightarrow \Lambda K^+ n\pi^+$ are 64 ± 6 μb, 39 ± 6μb, and 43 ± 4 μb, respectively. The resonances K*(890), N*(1236), and Y*(1385) are produced. In addition, the quasi-two-body reaction $pp \rightarrow NN^*(1950)$, $N^* \rightarrow Y^*K$ is observed. Except for the low $K\pi$ effective mass region, the data are found to be in good agreement with a pion exchange model. Author (NSA)

N69-24258# Joint Inst. For Nuclear Research, Dubna (USSR).
OBSERVATION OF THE ULTRA COLD NEUTRONS
V. I. Luschikov, Yu. N. Pokotilovskii, A. V. Strelkov, and F. L. Shapiro 1968 17 p refs In RUSSIAN
(JINR-P3-4127) Avail: AEC Depository Libraries

An experiment on observation of the ultracold neutrons performed on the pulsed fast reactor is described. The storage time of neutrons in copper tubes is equal to 200 sec. Author (NSA)

N69-24260# Scientific Translation Service, Ann Arbor, Mich.
STUDY OF THE DECAY OF PHOTONEUTRONS IN BERYLLIUM AFTER A FISSION OF U-235
Heinz Winter and Helen Deledicq Aug. 1968 18 p Transl. into ENGLISH from French Report CEA-Note N-971 Sponsored by ORNL
(ORNL-tr-2046; CEA-Note-N-971) Avail: CFSTI

The available data on photoneutron production in Be by ^{235}U fission-product γ rays were compiled, and photoneutron decay in Be was calculated directly from the spectrum of the fission-product γ rays of ^{235}U. The calculations were compared with the experimental data. NSA

N69-24281# Tokyo Univ. (Japan).
INSTITUTE FOR NUCLEAR STUDY Annual Report, Apr. 1967–Mar. 1968
Mar 1968 92 p
(NP-17704) Avail: AEC Depository Libraries

Research is reported on angular distribution and energy levels from proton inelastic scattering in aluminum-27; separation of antimony-121 and 123; angular distributions for helium-3 reactions with barium-138; fabrication of air-cored beta spectrometers; helium-3 reactions with cadmium-116 and carbon-12; energy levels in vibrational bands of cerium-138; meson capture in cobalt; detection and measurement of cosmic radiation and cosmic showers; energy levels in vibrational bands in gadolinium-150, 152, and 156; neutron scattering at 32 MeV using polarized beams in helium-4; separation of lead-204 and magnesium-24; energy levels from decay of isomeric technetium-94; differential cross sections for proton reactions in nickel-58; proton elastic and inelastic scattering at 12 to 15 MeV in nitrogen-14; energy levels from silver-105 decay in palladium-105; analysis for aluminum-26 produced by cosmic mesons; proton inelastic scattering and energy levels in silicon-26; separation of silicon-29, silicon-30, and silver-109; development of proton synchrotrons; deuteron reactions with tritium; separation of tungsten-182, 183, 184, and 186; and absorption measurements in gases and solids of X-radiation. NSA

N69-24289# Sandia Corp., Albuquerque, N. Mex.
DTFALL: A PROGRAM TO RUN PHOTON TRANSPORT PROBLEMS BY THE METHOD OF DISCRETE ORDINATES
K. G. Adams Oct. 1968 24 p refs
(SC-RR-68-712) Avail: CFSTI

A computer program is presented which combines into one program all procedures necessary to run a photon transport calculation with the use of the discrete ordinary method. Required inputs to run such a calculation have been simplified and minimized, and the described program is available upon request. Author (NSA)

N69-24297# Naval Radiological Defense Lab., San Francisco, Calif.
DECAY PROPERTIES OF 133Sb
William J. Treytl Sep. 1968 28 p refs
(AD-680259; USNRDL-TR-68-118) Avail: CFSTI CSCL 20/8

Radiations from the decay of 133Sb have been studied with use of solid state and scintillator gamma and beta detectors. Singles gamma, gamma-gamma, and beta-gamma measurements have been performed, and a decay scheme for 133Sb has been constructed consisting of levels at 0, 334, 979, 1152, 1679 and 2776 keV. Beta branches and log ft values have been deduced. The Q sub beta for 133Sb has been measured to be 3450 plus or minus 200 keV. The decay scheme is interpreted according to single-particle shell model and quasi-particle-phonon coupling theory. Some gamma rays have been attributed to 132Sb, principally one at 1024 keV which is probably the 2+ first excited level. Author (TAB)

N69-24299# Comitatio Nazionale per l'Energia Nucleare, Frascati (Italy).
LARGE ANGLE p-p SCATTERING, CERULUS-MARTIN BOUND AND THE VENEZIANO MODEL
M. Cassandro (Rome Univ.) and M. Greco 13 Dec. 1968 14 p refs
(LNF-68/74) Avail: CFSTI

The Veneziano model, modified in order to satisfy the Cerulus–Martin bound, is shown to give a very good description of p-p elastic scattering over the full range of t, but not the diffraction peak. Author

N69-24316# California Univ., Livermore. Lawrence Radiation Lab.
ON THE ANOMALOUS DIFFRACTION OF X-RAYS THROUGH PERFECT CRYSTALS
R. C. Schroeder May 1968 11 p refs
(UCRL-50439-Pt-1) Avail: CFSTI

A review of X-ray diffraction is given, and anomalous transmission of X-rays is discussed. The subject matter is treated in four parts, with part I covering a brief review of geometry and essentials followed by an outline of Ewald's derivation of the dispersion equations for X-ray diffraction as described by the dynamical theory. For part 2, please see accession number N69-12943. Author (NSA)

N69-24335# Joint Inst. For Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON POSSIBILITY OF USING DIRECT METHODS IN SCATTERING PROBLEMS
T. G. Efimenko, V. P. Zhigunov, and B. N. Zakharev 1968 16 p refs In RUSSIAN
(JINR-P4-4099) Avail: AEC Depository Libraries

The Ritz, Bubnov–Galerkin and the least squares methods are formulated for the scattering problem. Convergence of the sequential approximations to the precise solution and stability of the numerical solution with respect to the error in calculations, are discussed. The known difficulty of the Koon variation method, i.e. appearing of nonphysical singularities in the energy dependence of the scattering amplitude, is analyzed. The simple ways to overcome this difficulty are pointed out. The reactions with the particle rearrangement are considered. Author (NSA)

N69-24342# California Univ., La Jolla.
STRONG-INTERACTION DYNAMICS
W. R. Frazer Sep. 1968 32 p refs Presented at the 14th Intern. Conf. on High Energy Phys., Vienna, 28 Aug.–5 Sep. 1968
(Contract (AT(11-1)-Gen-10)
(UCSD-10-P-10-47; Conf-680809-40) Avail: CFSTI
Several approaches to strong-interaction dynamics are discussed. Finite-energy sum rule bootstraps are first discussed and are applied to the $\pi\pi \to \pi\omega$ reaction. The multiperipheral bootstrap scheme is then considered. A brief discussion is given of the method and some important results of Gribov–Migdal diagrams for Regge poles and cuts. A few qualitative remarks on the $t \to 0$ problem (conspiracy, Lorentz symmetry, etc.) are given. Finally, progress with the Padé approximate method of calculating scattering amplitudes is briefly reviewed. NSA

N69-24352# Dow Chemical Co., Golden, Colo.
NEUTRON MULTIPLICATION MEASUREMENTS OF PLUTONIUM INGOTS IN ARRAYS
Donald R. Ferguson 15 Dec. 1968 6 p
(Contract AT(29-1)-1106)
(RFP-1242) Avail: CFSTI
Neutron multiplication measurements on partially moderated and partially reflected arrays of 55 gallon drums are presented. Each drum contains a Pu ingot of about 12 kilograms with a density of 15.8 grams per cubic centimeter. Author (NSA)

N69-24355# Wien Univ. (Austria). Inst. fuer Theoretische Physik.
HIGH ENERGY PHYSICS Final Scientific Report
Walter E. Thirring Aug. 1968 10 p refs
(Contract AF 61(052)-959)
(AD-680287; AFOSR-68-2876) Avail: CFSTI CSCL 20/8
Research has been carried out in Current Algebra (Sum rules and the problem of gradient terms). Weak hadronic decays have been computed in the quark model. Finally, quantum field theory in de Sitter space and a spin-waveformulation of the BCS-model are studied. Author (TAB)

N69-24362# Saigon Univ. (South Vietnam). Dept. of Physics.
ON THE ENERGY SPECTRUM IN 3-BODY NUCLEAR REACTIONS
Cao-Xuan-Chuan [1966] refs
(KHVL-102) Avail: AEC Depository Libraries
The extent of deformation in the shape of the energy spectrum calculated from pure phase-space considerations is examined. A single final-state interaction between two of the three outgoing particles is assumed. The analysis shows that this spectrum depends strongly on kinematical factors when the recoil is not neglected. Author (NSA)

N69-24363# United Kingdom Atomic Energy Authority, Harwell (England).
NEUTRON CROSS SECTIONS AND STRENGTH FUNCTIONS FOR GERMANIUM ISOTOPES
H. Maletski Dec. 1967 12 p refs Transl. into ENGLISH from Russian Rept. JINR-P3-3456
(NP-TR-1719; JINR-P3-3456) Avail: CFSTI
Neutron resonance parameters and strength functions for the Ge isotopes were determined from radiate capture, self-indication, and transmission measurements by the time-of-flight method. Level parameters were also calculated. Potential scattering cross sections were determined for the energy range 3 to 1000 eV. The data was in fair agreement with theoretical values and other experimental data. NSA

N69-24365# Brookhaven National Lab., Upton, N. Y.
THE SPECTRUM OF VIBRATIONAL AND ROTATIONAL EXCITATIONS OF FOUR-PARTICLE SYSTEM [SPEKTR KOLEBATELNYKH I VRASHCHATELNYKH VOZBUZHDENII SISTEMY CHETYREKH CHAST ITS]
G. F. Filippov 1968 22 p refs Transl. into ENGLISH from Russian Preprint Sponsored by AEC
(ITF-68-14) Avail: AEC Depository Libraries
The vibrational and rotational spectrum of a four-particle system in which the two particle interaction corresponds to the repulsion when distances between the particles are small and to the attraction otherwise is studied. In the case of four similar particles, the Hamiltonian of small vibrations is analogous to that of the generalized model for spherical nuclei, and there is no low-lying rotational spectrum. In the case for which the inertia ellipsoid of the equilibrium shape has a symmetry axis, the rotational spectrum makes its appearance. Author (NSA)

N69-24385# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
OVERLAPPING POTENTIALS AND MULTIPLE SCATTERING THEORY
Herman Feshbach Oct. 1968 17 p refs
(Contract AT(30-1)-2098)
(MIT-2098-495; CTP-44) Avail: CFSTI
A formulation of multiple scattering theory is proposed which makes use of the impact parameter approximation and the expansion of the phase shift function in one, two and many body operators. Explicit results are given for the case in which the expansion is truncated after two terms, retaining the one and two body terms. Evaluation is obtained by appropriate use of the semiclassical physical optical approximation. It is used to show that the effect of the overlap in the incident nucleon-target nucleon potentials can be important for the determination of correlations in the target nuclear wave function by elastic scattering. The use of experiments which are more sensitive to correlation effects is thus recommended. Author (NSA)

N69-24388# California Univ., Livermore. Lawrence Radiation Lab.
THE DECAY OF Lu-170
N. A. Bonch-Osmolovskaya et al Nov. 1968 36 p refs Transl. into ENGLISH from Russian Rept. JINR-P6-3452
(UCRL-Trans-10306; JINR-P6-3452) Avail: CFSTI
The γ-ray spectra from ^{170}Lu decay was measured, and the ^{170}Lu decay scheme constructed and analyzed. Author (NSA)

N69-24432# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
PHOTODISINTEGRATION AND PHOTOPRODUCTION IN HE-3 WITH A DIFFUSION CHAMBER [FOTODISINTEGRAZIONE E FOTOPRODUZIONE IN He-3 CON CAMERA A DIFFUSIONE]
G. Goggi, G. C. Mantovani, A. Piazza, A. Piazzoli, and D. Scannicchio 10 Dec. 1968 27 p refs In ITALIAN
(LNF-68/73) Avail: CFSTI
Diffusion chamber experiments in photodisintegration and photoproduction of pions in helium 3 are reported. The experimental apparatus and procedures are described. A preliminary data analysis shows that the results of the photodisintegration are in excellent agreement with other authors. However, the results of the photoproduction of pions yielded higher values in comparison with other experiments. Transl. by F.O.S.

N69-24434# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
A NOTE ON THE ENERGY DEPENDENCE OF THE RADIATIVE STRENGTH FUNCTION
A. R. de L. Musgrove Sep. 1968 9 p refs
(AAEC/TM-467) Avail: AEC Depository Libraries

The simple Blatt and Weisskopf estimate for radiative width is used, with an improved formula for the density of levels near the ground state (Gilbert and Cameron 1965), to calculate the energy dependence of the radiative width and the radiative strength function. It is found that the radiative width decreases while the radiative strength function exhibits a slow increase with increasing neutron bombarding energy. Author (NSA)

N69-24438# Oak Ridge National Lab., Tenn.
ARTUS PROGRAM: CALCULATION OF THE QUANTITIES OF ENERGY RELEASED BY NEUTRONS IN A SOLID
Bertrand Barre Oct. 1967 36 p refs Transl. into ENGLISH from French Rept. CEA-N-827 Sponsored by AEC
(ORNL-TR-2044; CEA-Note-N-827) Avail: CFSTI

The programs described were formulated on the occasion of a special study relative to the influence of the ionization of CO_2 by neutrons on the reaction CO_2–graphite. They are described from the standpoint of this study. It is shown that they can be used for the solution of a group of much more general problems. NSA

N69-24460# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
LOW'S PARTICLE: A REVIEW OF EXPERIMENTAL AND THEORETICAL DATA AND A PROPOSAL FOR A $e^+ e^- \rightarrow \gamma\gamma$ ADONE EXPERIMENT
P. Costa and F. Grillo 6 Nov. 1968 9 p refs *Its* Nota Interna No. 417
(LNF-68/63) Avail: CFSTI

Using Low's proposal to explain possible violations of quantum electrodynamics by introducing new particles and interactions, the cross section of the reaction $e^+ e^- \rightarrow \gamma\gamma$ is calculated, supposing the existence of a particle (L^+) with mass greater than the mass of the electron and the same quantum numbers. The interaction of the L-particle with the electrons is described by a non-minimal Hamiltonian. The limitations imposed on the Low particle parameters are examined, and conditions are derived for the possibility of measuring its contribution to the reaction in colliding beam experiments. The main obstacle in the way of measuring this contribution appears to be the anomalous magnetic moment of the electron. An experiment showing the contribution of L may be possible at energies above 3 to 4 GeV. P.A.B.

N69-24483# Technische Hochschule Munchen (West Germany). Fakultaet Fuer Allgemeine Wissenschaften.
STUDY OF GAMMA RAYS OF AG 110 AFTER NEUTRON CAPTURE (UNTERSUCHUNG DER GAMMASTRAHLUNG VON AG 110 NACH NEUTRONENEINFANG)
Hans-Ulrich Freund (Ph.D. Thesis) 1967 53 p refs In GERMAN
Avail: CFSTI

Germanium-lithium detectors were used to measure gamma radiation from captured neutrons in silver 109. Transfer electron intensities were analyzed to determine spin and parity of the various energy levels during isotopic decay. Transl. by G.G.

N69-24484# Technische Hochschule Munchen (West Germany). Fakultaet Fuer Allgemeine Wissenschaften.
MEASUREMENTS OF γ-ANGULAR DISTRIBUTION AFTER NEUTRON CAPTURE ON ALIGNED Ho 165 NUCLEI [MESSUNG DER γ-WINKELVERTEILUNG NACH DEM NEUTRONENEINFANG AN AUSGERICHTETEN HO 165-KERNEN]
Guenter Zimmer (Ph.D. Thesis) Jul. 1968 22 p refs In GERMAN
Avail: CFSTI

Holmium 165 was aligned in a holium methylsulfate single crystal by cooling to 0.34°, and its high energy gamma radiation was measured by coaxial germanium lithium detector. Compound level spins of 3^- and 4^- developed through neutron capture. Observed values were evaluated for 13 holmium 166 spin levels. Spin values for the six lowest levels showed good agreement with earlier data, whereas values for 430 KeV differed and only the spin to 4^+ was determined at the 558 KeV level. Transl. by G.G.

N69-24533# Australian National Univ., Canberra. Research School of Physical Sciences.
LINE SHAPE ANALYSIS OF SPECTRA OBTAINED WITH Ge(Li) DETECTORS
F. C. Huang, C. H. Osman, and T. R. Ophel 1968 19 p refs
(ANU-P-413) Avail: AEC Depository Libraries

Line shape analysis techniques have been applied to gamma ray spectra obtained with a Ge(Li) detector. It was found that least squares fitting procedures enabled more accurate and rapid extraction of relative intensities than was possible from the areas of the full energy or double escape peaks. Author (NSA)

N69-24545# Joint Inst. for Nuclear Research, Dubna (USSR).
ON SPONTANEOUS FISSION OF LEAD; SEARCH FOR VERY FAR TRANSURANIUM ELEMENTS
G. N. Flerov and V. P. Perelygin 1969 7 p refs In RUSSIAN
(JINR-P7-4205) Avail: AEC Depository Libraries

With the help of charged-particle detectors the tracks of the nuclear fission fragments in Pb and its compounds were detected. For lead glass, this effect corresponds to an apparent half-life of spontaneous fission of Pb equal to 2 to $3 - 10^{20}$ years. The effect observed may serve as an assumption about the existence of long-lived spontaneously fissioning transuranium nuclide. Author (NSA)

N69-24574# Comitato Nazionale Per l'Energia Nucleare, Frascati (Italy).
DOUBLE NEGATIVE PION PHOTOPRODUCTION MEDIUM WEIGHT NUCLEI
B. M. Belli, V. Di Napoli, F. Laitano, D. Margadonna, P. Picchi et al 18 Nov. 1968 13 p refs *Its* Nota Interna No. 418
(LNF-68/66) Avail: CFSTI

Double charge exchange of pions on nuclei are analyzed to give information on nuclear isobaric analog states and nuclear correlations. Simulation techniques using the electron synchrotron were employed, and the gamma and beta radiation of A(N-2, Z+2) was detected with coincidence methods after radiochemical separation attenuated the activity of the radionuclides formed by spallation reactions. Brief descriptions are given of the theory of the reactions, the experimental apparatus, and the radiochemical methods. The results of the preliminary study of the reaction $\gamma + Mn^{55} \rightarrow Co^{55} + 2\pi^-$ are presented. A.C.R.

N69-24576# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
COLLISION CASCADES IN GOLD IN THE ENERGY RANGE 3 TO 189 keV

R. Hancock, A. G. Warner, and R. L. Wooley Nov. 1968 21 p refs
(RD/B/N-1212) Avail: AEC Depository Libraries

A comprehensive study of collision cascades of Pb ions in Au targets was made, using apparatus built to measure the energies of ions scattered from thin absorber foils into a solid angle of 2π steradians. The Pb ions were obtained by recoil from radioactive alpha disintegration and the energies of ions in the cascade were measured by a time-of-flight technique. Author (NSA)

N69-24578# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
DEVELOPMENT OF NEUTRON RADIOGRAPHY WITHIN THE CEA [DEVELOPPEMENT DE LA NEUTROGRAPHIE AU SEIN DU CEA]
J. L. Boutaine [1968] 23 p refs In FRENCH; ENGLISH summary Presented at Symp. on Nondestructive Testing and Control in the Field of Nucl. Met. and Tech., Saclay, France, 24 June 1968
(CEA-Conf-1075; Conf-680606-4) Avail: AEC Depository Libraries

In 1966 the first neutron radiography tests were carried out by the CEA in the swimming pool reactors PEGGY at Cadarache and MELUSINE at Grenoble on experimental rigs. Since then, it has been possible to refine the process and to develop certain particular uses of this nondestructive inspection method. The advantages and disadvantages of the neutron radiography method are summarized. The devices in service in the CEA are described and some examples of their present-day practical use in nuclear technology are given as well as some suggestions for their use outside nuclear energy. The first results of research on the possibilities of using neutron generators and radioisotopic sources are described. Author (NSA)

N69-24599# Brown Univ., Providence, R. I. Dept. of Physics.
THEORETICAL HIGH-ENERGY PHYSICS Progress Report, 1 Sep. 1967–31 Aug. 1968
David Feldman 1 Jun. 1968 9 p refs
(Contract AT(30-1)-2262)
(NYO-2262-TA-184) Avail: CFSTI

A summary is presented of research on theoretical physics during the year September 1967, to August 31, 1968. The present status of the theoretical group, brief summaries of papers published and to be published, and the scientific personnel are considered. NSA

N69-24601# California Univ., Berkeley. Lawrence Radiation Lab.
MEASUREMENT OF LIFETIMES BY THE PHASE-SHIFT METHOD. 1: RADIATIVE LIFETIMES OF SOME EXCITED ATOMIC STATES. 2: LIFETIMES OF SOME VIBRATIONAL REGIONS ON THE B STATE OF IODINE
Paul T. Cunningham (Ph.D. Thesis) Nov. 1968 92 p refs
(Contract W-7405-eng-48)
(UCRL-18419) Avail: CFSTI

The phase-shift technique was used to measure radiative lifetimes for excited atomic states of eleven elements. Data were obtained over a large enough range of fluorescence radiance to permit evaluation of the effects of radiation entrapment and scattered exciting radiation. Estimated uncertainties range from 2% to 6%. The measured lifetimes were converted to absorption f-values for the transitions depopulating the states studied by use of relative f-values from the literature. Lifetime measurements were made on the B state of I_2 excited to vibrational levels around $v' \approx 15$, 28, and 60. The lifetimes measured for $v' \approx 15$ vary with the frequency of modulation of the exciting light. The results are compared with previous measurements reported in the literature and all data are interpreted in terms of a weak spontaneous predissociation of the B state. Author (NSA)

N69-24609# Aktiebolaget Atomenergi, Studsvik (Sweden).
Pu-239 EVALUATIONS
Marie Wallin 7 Dec. 1967 11 p refs
(TPM-RFR-682) Avail: AEC Depository Libraries

The updating of the Speng library for ^{239}Pu to reflect recent measurements and evaluations of the cross sections and resonance parameters for ^{239}Pu is discussed. NSA

N69-24614# Stanford Univ., Calif. Dept. of Mechanical Engineering.
A STUDY OF RADIATION-INDUCED NUCLEATION OF BUBBLES IN SUPERHEATED WATER Annual Progress Report
L. W. Deitrich and T. J. Connolly 23 Dec. 1968 16 p refs
(Contract AT(04-3)-326)
(SU-326-P-13-3) Avail: CFSTI

Work was carried out to make the bubble chamber radiation sensitive. This resulted in the achievement of bubble nucleation by fission fragments emitted from a $^{235}UO_2$ plate. A measurement of the superheat threshold for nucleation by fission fragments was obtained over the range from 380 to 440°F. NSA

N69-24638# Scientific Research Atomic Reactor Inst., Melekess (USSR).
THE CALCULATION OF TRANSPORT OPERATOR SPECTRUM IN THE SPHERICAL GEOMETRY FOR MONOENERGETIC NEUTRONS WITH SCATTERING ANISOTROPY BEING TAKEN INTO ACCOUNT AND FOR NELKIN THERMALIZATION MODEL [RASCHET SPEKTRA OPERATORA PERENOSA V SFERICHESKOI GEOMETRII DLYA MONOENERGETICHESKIKH NEITRONOV S UCHETOM ANIZATROPII ROSSEYANIYA I DLYA STERMALIZATSIONNOI MADELI NECKINA]
A. A. Shkurpelov and S. B. Shikhov 1968 32 p refs In RUSSIAN
(SRARI-P-8) Avail: AEC Depository Libraries

Some problems of neutron transport theory are considered. A method is suggested by means of which the operator spectrum for monoenergetic neutron transport in spherical geometry may be calculated considering scattering anisotropy. Account is taken of the energetic energy-cross section relation by the Nelkin thermalization pattern. The appropriate analytical formulas for the calculation of the eigenvalues are obtained. Eigenvalue-sphere radius relations are shown. Author (NSA)

N69-24648# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
QUANTITATIVE DETERMINATION OF IMPURITIES IN NUCLEAR GRAPHITE BY ACTIVATION ANALYSIS
S. May and G. Pinte 13 Mar. 1968 17 p refs In FRENCH Presented at the Intern. Conf. on Modern Trends in Activation Analysis, Gaithersburg, Md.
(CEA-Conf-1057; Conf-681003-9) Avail: AEC Depository Libraries

A neutron activation method was developed for the systematic analysis of one nuclear graphite sample for Ag, Si, Hg, Sb, Cu, Fe,

Ga, Co, Cd, Zn, In, Zr, Cr, Sc, Ba, Ca, Na, K, Rb, and Cs. Methods used for the determination of all the rare earths, S, and P, as well as elements that can be determined without chemical separation, Cl, Mn, and V, are also presented. NSA

N69-24653 Yale Univ., New Haven, Conn.
NONRELATIVISTIC APPROXIMATION TO THE HYPERFINE STRUCTURE OF THE $1s2s^3S_1$ STATE OF He^3
James Angell MacLachlan, Jr. (Ph.D. Thesis) 1968 184 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-14848

A nonrelativistic coordinate wave function is calculated by the Rayleigh-Ritz variational method from a Schroedinger equation containing the Hughes-Eckart nuclear motion term. An expansion of the wave function in Legendre polynomials of the cosine of the angle between electron-nucleus displacements reduces the Schoredinger equation to an infinite set of coupled two-dimensional problems. The wave function is used to evaluate the hyperfine structure integral factor $1 + \epsilon$ of Breit and Doermann, and the numerical uncertainty in this quantity is discussed. A basic feature of the calculation is the use of piecewise smooth trial functions in the variational method. Some refinements and extensions of this technique, which was applied to the related Li^+ problem, are described in detail. Particular consideration has been given to a refinement for the region of configuration space most responsible for electron-nuclear-spin coupling. Dissert. Abstr.

N69-24654# Kansas Univ., Lawrence. Nuclear Physics Lab.
[ACTIVITIES OF THE NUCLEAR STRUCTURE GROUP AT THE UNIVERSITY OF KANSAS] Progress Report, 1 Aug. 1967–31 Jul. 1968
23 Sep. 1968 69 p refs
(Contract AT(11-1)-1120)
(COO-1120-78) Avail: CFSTI

The lifetimes of energy levels in ^{15}N from the reaction $^{14}C(p,\gamma)^{15}N$ were measured using the Doppler shift attenuation method. A technique for determining the parity of nuclear states by measuring the linear polarization of γ rays was tested; support for assignments of positive parity to the 10.54- and 10.81-MeV states of ^{15}N was obtained. The reaction $^{32}S(p,\gamma)^{33}Cl$ was investigated between E_p = 1880 and 1920 keV. The branching ratio of the 3.90-MeV state to the 3.35-MeV state of ^{40}Ca was determined. A method for making triple angular correlation measurements by analyzing the energy distributions of γ rays emitted as the final transition of a particle-particle-γ reaction was developed and was tested using the reactions $^{19}F(p,\alpha\gamma)^{16}O$ and $^{15}N(p,\alpha\gamma)^{12}C$. The $^{31}P(^3He,p)^{33}S$ reaction was investigated at 12 MeV; elastic scattering measurements were made at the same energy to define the optical model parameters. The application of the quasiparticle method to two-nucleon problems involving smooth velocity-dependent potentials was studied. Author (NSA)

N69-24656# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
THE CALCULATION OF THE EFFECTIVE RESONANCE INTEGRALS, THE RESONANCE ESCAPE PROBABILITY, AND THE DOPPLER COEFFICIENT IN HETEROGENEOUS SYSTEMS
J. Stepanek [1967] 60 p refs
(UJV-2010) Avail: AEC Depository Libraries

The basic theory of neutron resonance absorption in heterogeneous systems is discussed. Calculated values of materials constants are tabulated; resonance integral ratios are listed. Temperature coefficients and resonance integrals are shown graphically. NSA

N69-24681# Joint Inst. for Nuclear Research, Dubna (USSR).
SYNTHESIS AND STUDY OF NEW ISOTOPES AND ELEMENTS
G. N. Flerov 1968 11 p refs
(JINR-E7-4207) Avail: AEC Depository Libraries

The synthesis of new elements and, in particular, the problems of the synthesis of super-heavy elements in the range of nuclear atomic numbers from 110 up to 114 are discussed. Author (NSA)

N69-24695# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON A POSSIBLE FACTORIZATION OF TWO-PARTICLE T-MATRIX IN THE THREE-BODY PROBLEM
U. B. Belyaev and J. Wrzecionko 1968 18 p refs In RUSSIAN
(JINR-P4-4144) Avail: AEC Depository Libraries

A simple and clear method of factorization of the local potential is proposed. For smooth potentials of the Yukawa type the procedure is quite simple and gives a good approximation of the local potential. For the Yukawa potential the two-particle T-matrix was calculated and its off-energy shell behavior was investigated. A sharp discrepancy in the behavior of the Yamaguchi T-matrix and the calculated T-matrix was established. Author (NSA)

N69-24715# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
THE PHOTOPRODUCTION OF RHO MESONS WITH GAMMA QUANTA OF KNOWN ENERGY [DIE PHOTOPRODUKTION VON RHO MESONEN MIT GAMMA QUANTEN BEKANNTER ENERGIE]
Horst Blechschmidt Feb. 1968 72 p refs In GERMAN; ENGLISH summary
(DESY-F-32/4) Avail: AEC Depository Libraries

In a spark chamber experiment, pion pairs produced by energy-tagged photons on hydrogen, carbon and aluminum were measured. For ρ^0-production, the differential cross section $d\sigma/dt$ exhibits and exponential behavior like $(d\sigma/dt)_{t=0} \cdot e^{at}$ with $a \sim A^{1.68 \pm 0.1}$ and $(d\sigma/dt)_{t=0} \sim A^{2/3}$. The differential cross section for ρ^0-photoproduction in the forward direction $(d\sigma/d\Omega)_{\theta=0}$ was found to be proportional to the square κ^2 of the energy of the incoming photon. The resulting total cross sections are σ_{tot} = 14.6 ± 1.8 μb for H_2, σ_{tot} = 130 ± 22 μb/nucleus for C and σ_{tot} = 284 ± 40 μb/nucleus for Al. Author (NSA)

N69-24740# California Univ., Los Angeles. Dept. of Physics.
RESEARCH PROGRAM OF THE NUCLEAR CONSORTIUM AT THE UCLA CYCLOTRON LABORATORY
J. Reginald Richardson, Byron T. Wright, William H. Louisell (Univ. of Southern Calif., Los Angeles), and Robert M. Eisberg (California Univ., Santa Barbara) Jul. 1968 122 p refs
(Contract AT(11-1)-GEN-10)
(UCLA-10-P-18-10) Avail: CFSTI

Experimental studies were made of the proton-induced breakup of D, ^3He, and ^4He; proton elastic scattering by D and ^4He; proton-induced reactions on ^{14}N; proton elastic and inelastic scattering by ^{16}O; the reactions $^{19}F(p,t)^{17}F$ and $^{19}F(p,^3He)^{17}O$; the reaction ^{20}Ne $(p,p\alpha)^{16}O$; the reaction $^{89}Y(p,2p)^{88}Sr$; proton-induced reactions on ^{209}Bi; nuclear bremsstrahlung in proton bombardment of ^{12}C; first forbidden β decay of ^{139}Ba; energy losses by fast charged particles in Si; nuclear reaction efficiency corrections for Ge and Si detectors; and the problem of nuclear reactions in high-energy stopping counters. Proton total cross

sections for ^{9}Be, ^{12}C, ^{16}O, and Si were measured between 24 and 46 MeV. Analyses of the proton-induced breakup of D and ^{4}He and of the reaction $^{12}C(p,2p)^{11}B$ were performed, as was an optical model analysis of proton elastic scattering by ^{16}O at 23 to 53 MeV. Log-ft values were calculated for allowed, pure Gamow–Teller transitions in even-A single closed shell nuclei with Z = 28, Z = 50, and N = 82. NSA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N69-23440*# Volt Information Sciences, Inc., Washington, D. C.
PLASMA HEATING BY MAGNETO-ACOUSTIC WAVES [NAGREV PLAZMY MAGNITNO-ZVUKOVYMI VOLNAMI]
I. A. Kovan et al Greenbelt, Md. NASA, Goddard Space Flight Center 17 Apr. 1969 27 p refs Transl. into ENGLISH from Atomnaya Energ. (Moscow), v. 25, no. 6, 1968 p 503–506
(Contract NAS5-12487)
(NASA-CR-100698; ST-PP-MAW-10825) Avail: CFSTI CSCL 20E

A discussion of the possibilities of using the magneto-acoustic resonance for heating the ion component of a plasma is presented. The experimental apparatus is described in detail. Explored also is the possibility of plasma heating by oblique magneto acoustic waves of great amplitude. The scheme of this experiment is also described. Author

N69-23451*# United Aircraft Corp., East Hartford, Conn.
NUCLEAR STUDIES OF THE NUCLEAR LIGHT BULB ROCKET ENGINE
Thomas S. Latham Washington NASA Apr. 1969 81 p refs
(Contract NASw-847)
(NASA-CR-1315; G-910375-3) Avail: CFSTI CSCL 20I

Analytical studies were conducted to determine U-233 critical mass requirements, neutron kinetic behavior, and neutron and gamma ray heating rates for the nuclear light bulb rocket engine. The nuclear light bulb is a multiple-cavity gaseous nuclear rocket engine in which energy is transferred by thermal radiation from gaseous nuclear fuel through internally cooled transparent walls to seeded hydrogen propellant. The engine considered in this report employs seven separate cavities, each having a length of 6 ft and an average diameter of 2.3 ft. Beryllium oxide is employed between the unit cavities, and layers of BeO and graphite surround the seven units to provide neutron reflection. The criticality analysis allowed the effects of engine design changes on critical mass to be investigated. Among the factors that were varied were the total moderator mass, the amount of BeO between unit cavities, the distribution of moderator mass, the amount of tungsten seed in the hydrogen propellant, and the amount of hafnium required to shield the fuel injection and recirculation system ducts. The analysis also considered factors affecting the kinetic behavior of a nuclear light bulb engine. Author

N69-23480 Drexel Inst. of Tech., Philadelphia, Pa.
DECAY OF PLANE MAGNETOHYDRODYNAMIC AND GAS DYNAMIC SHOCKS IN AN IDEAL GAS
Robert Raymond Karpp (Ph.D. Thesis) 1968 71 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-13550

The problem of a plane shock decayed by an overtaking rarefaction wave has been solved by a new approximate, analytical method. Solutions have been obtained for shocks in an ideal gas and for shocks in a perfectly conducting ideal gas with an applied magnetic field. These solutions have been compared with an existing approximate method due to Friedriche. For weak shocks, both solutions agree in the early stages; however, a significant difference arises for large values of time. Friedriche' method indicates that the width of the shock wave increases monotonically with time, but the present method predicts that the width of the shock wave reduces to zero in a finite time. Results from a numerical solution based on the method of characteristics also indicate that the width of the shock wave decreases to zero. Dissert. Abstr.

N69-23498 Stanford Univ., Calif.
EXPERIMENTAL ELECTRODE CURRENT DISTRIBUTIONS IN MHD CHANNELS
Jerome Leigh Kurz (Ph.D. Thesis) 1968 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-15070

The distribution of current on the electrodes of a single-pair MHD channel was investigated experimentally. The experiments were performed with a flowing, atmospheric-pressure, alkali-metal-seeded argon plasma at temperatures between 1980°K and 2150°K for Hall parameter values up to seven. Two electrode configurations were investigated; one with the electrodes projecting into the flowing plasma, the other with the electrodes flush with the channel wall. Qualification measurements showed that the plasma free-stream conditions were uniform across the channel and in agreement with equilibrium calculations. Results for the anode current distribution were in all cases in good agreement with the theoretical predictions. The cathode current distribution was found to agree less well with the predictions. Dissert. Abstr.

N69-23533*# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
PRESSURE DISTRIBUTION IN THE STRUCTURE OF A PROPAGATING CURRENT SHEET
Thomas M. York (Ph.D. Thesis) Dec. 1968 145 p refs
(Grant NGL-31-001-005)
(NASA-CR-100693; Rept-853) Avail: CFSTI CSCL 20I

The structure of a current sheet propagating into ambient argon is studied experimentally and analytically. The current sheet in a linear z-pinch device is examined experimentally with a specialized high-speed pressure transducer, magnetic, electric and voltage probes, along with the photography of discharge luminosity. The pressure probe is used to measure profiles of axial and radial pressure at a single point in the chamber; this data is time-correlated with electric and magnetic field profiles. The experimental results indicate a discontinuous compression followed by a sharp expansion within the sheet structure. Profiles of particle density, temperature, and velocity are evaluated. From these results, ions are identified as the current carriers in the rear of the sheet. The current sheet is found to entrain a large percentage of gas. A balance of momentum and energy is carried out, with the resultant identification of loss mechanisms. Author

N69-23582 North Carolina State Univ., Raleigh.
THEORY OF THE CYLINDRICAL LANGMUIR PROBE IN A FLOWING COLLISIONLESS PLASMA
Peter Wendell McDonald (Ph.D. Thesis) 1968 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-14866

An exact method is developed to obtain theoretical predictions of the current collected by a cylindrical Langmuir probe in a moving collisionless plasma. The method is not restricted to a particular range of the four parameters; however, the results that are presented were limited by the availability of computer time.

The computations were carried out on an IBM 360/75. The infinite plasma is represented by a boundary at a finite radius outside the sheath of the probe. Although any velocity distribution may be assumed at this boundary, only monoenergetic solutions have been computed thus far. The ion density distribution and current are determined from thousands of ion trajectories in an iterative scheme along with the potential distributions in the sheath. Dissert. Abstr.

N69-23628# Academy of Sciences (USSR), Moscow.
HOT PLASMA PRODUCTION DURING INJECTION OF CLUSTERS OF FAST ATOMS INTO MAGNETIC TRAPS
K. B. Kartashev, V. I. Pistunovich, and E. A. Filimonova 1967 19 p refs In RUSSIAN
(IAE-1399) Avail: AEC Depository Libraries

Descriptions are given of a new method for producing hot plasma in magnetic traps by injection of dense fast atom clusters. The capture of atoms is achieved either by the incoming cluster or by short-life plasma targets. Author (NSA)

N69-23671 Stanford Univ., Calif.
RADAR INTERFEROMETRY MEASUREMENTS OF THE PROPERTIES OF A TURBULENT PLASMA
David Everett Weissman (Ph.D. Thesis) 1968 65 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-11372

A diagnostic technique was developed for the measurement of the spatial size of a bounded turbulent plasma. This involved an electromagnetic scattering technique which could measure the spatial distribution of the scattering cross section per unit volume of an inhomogeneous turbulent plasma. The size information is contained in the spatial distribution of the parameters that affect the cross section per unit volume. The parameters are also measured independently using probes. The desirable features of the technique studied were that it could be performed from a remote location outside the region of interest and, because the interaction with the dielectric material was electromagnetic, it did not perturb the parameters of the plasma. This study centered about a laboratory-produced turbulent plasma column from which microwave electromagnetic energy in the form of essentially a plane monochromatic wave was backscattered. Dissert. Abstr.

N69-23876 Saskatchewan Univ., Saskatoon.
ELECTRON-NEUTRAL MOMENTUM TRANSFER CROSS SECTIONS AND CONDUCTIVITY RATIOS IN SOME RARE GASES
Clarence Robert John Hoffmann (Ph.D. Thesis) 1968 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-14628

Conductivity ratios have been measured as functions of electron temperature in weakly ionized helium, neon, krypton and xenon plasmas. The measurements, which provide information on the momentum transfer cross sections for electron-neutral atom collisions, were carried out in the afterglow of a repetitively pulsed electrodeless radio frequency discharge produced in a racetrack-shaped container in the presence of a dc magnetic field. A microwave resonant cavity technique is used to measure the complex plasma admittance without causing any significant perturbation of the plasma. Under certain conditions, which are discussed in detail, the plasma admittance is directly related to the conductivity ratio. Unlike previous experiments of this kind the electron temperatures are measured directly. This is accomplished by using a gated microwave radiometer technique that compares the microwave radiation originating in the plasma in a small bandwidth to that from a known temperature blackbody noise source. Dissert. Abstr.

N69-23787*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SEMIEMPIRICAL COLLISION MODEL FOR PLASMAS
Willard E. Meador Washington May 1969 35 p refs
(NASA-TR-R-310) Avail: CFSTI CSCL 20I

A collision model similar in many respects to that of a Lorentz gas is developed for plasmas. Two assumptions are made: (1) the totality of interparticle force laws (including electron–electron) can be replaced with a single parameter determined by the unique ratio of generalized electric field to temperature gradient that can exist in a bounded, nonmagnetic, and currentless plasma of given composition; (2) the electron dynamics governed by such an average potential are Lorentz-like in the sense that the effective electron collision partners behave as heavy scattering centers. With the collision model thus specified and held fixed, the first order kinetic equation is solved exactly for a succession of more complex plasma conditions; the corresponding distribution functions are used to predict such diverse properties as entropy, entropy and diffusion relaxation times, electromagnetic tensor conductivities, thermal conductivity, and thermal diffusion. The method apparently provides an adequate scheme for utilizing experimental data when microscopic collision parameters are scarcely known and by directly extending previous calculations to more complex conditions. Author

N69-23923# California Univ., Livermore. Lawrence Radiation Lab.
PLASMA CONFINEMENT IN THE LEVITRON
O. A. Anderson, D. H. Birdsall, C. W. Hartman, E. J. Lauer, and H. P. Furth 19 Jun. 1968 26 p refs Presented at the 3rd Intern. Conf. on Controlled and Plasma Phys., Novosibirsk, USSR 1–7 Apr. 1968
(Contract W-7405-ENG-48)
(UCRL-70932; CONF-680805-8) Avail: CFSTI

Confinement of gun-injected plasma and anisotropic hot electron plasma is investigated in the Levitron. Field configurations are employed which have strong shear ($L_s/r_p \approx 0.1$ to 1), reversible gradient in average B, and a local minimum $|B|$ mirror region of the Kadomtsev type embedded in the closed toroidal flux surfaces. Author (NSA)

N69-23932# Sperry Rand Research Center, Sudbury, Mass.
ELECTROACOUSTIC RESONANCES IN A NONUNIFORM PLASMA
Harry N. Ewald Oct. 1968 25 p refs
(Contract F19628-67-C-0096)
(AD-680407; SRRC-CR-68-41; AFCRL-68-0509) Avail: CFSTI CSCL 20/9

In this work, a theory of the electroacoustic resonances of a nonuniform plasma that is based upon an expansion of the Vlasov equation is presented. The results of the expansion, when combined with Maxwells equations, yield a single differential equation describing the rf acceleration as a function of distance into the plasma. The solution for the eigenmodes of a diffusion controlled plasma are obtained using a boundary condition that is based upon the reflection of electrons from the steady electric field in the plasma. The effects of collisionless (Landau) damping are considered by comparing the unperturbed electron trajectories with the velocities of the waves constituting the resonances in the phase plane. The eigenvalues for the resonances are compared with those obtained from moment theory. Author (TAB

N69-23934# Air Force Academy, Colo. Frank J. Seiler Research Lab.
JUMPS ACROSS TRANSVERSE IONIZING MHD SHOCK WAVES IN REAL HYDROGEN USING B COMPRESSION AS A PARAMETER. AN EXPLICIT DESCRIPTION OF THE STATE OF AN EQUILIBRIUM HYDROGEN PLASMA

Charles F. Stebbins and Duane W. Clawson Oct. 1968 25 p ref
(AD-680447; SRL-68-0006) Avail: CFSTI CSCL 20/9

The equations which describe an equilibrium hydrogen plasma with chemistry are presented as nine equations in nine unknowns. The derived state equations are applied in conjunction with the conservation equations and Maxwells equations to predict jumps across transverse, ionizing MHD shock waves propagating into hydrogen. The jump equations were solved on a digital computer using the magnetic field compression as a parameter. This field compression, for various values of initial field, was set equal to 1, corresponding to ordinary shock waves, and was set equal to the ordinary gas compression across the shock, corresponding to pure MHD shock waves. The resulting post-shock temperature, density, electric field, and pressure as well as the mass fractions of the various plasma constituents, are presented graphically as functions of shock Mach number. The resulting curves are interesting in that they graphically demonstrate the interaction of the initial transverse magnetic field with the plasma; and they are useful in that they provide a means of estimating ranges in jumps across transverse ionizing shocks without prior knowledge of the character of the shock (ordinary, intermediate, or MHD). Author (TAB)

N69-23954# Princeton Univ., N. J. Plasma Physics Lab.
A CURSORY LOOK AT TOKAMAK FUSION REACTORS
R. G. Mills Dec. 1968 15 p refs
(Contract AT(30-1)-1238)
(MATT-659) Avail: CFSTI

Hypothetical fusion reactors of the Tokamak and stellarator types are extremely similar. The similarities include the following five points: (1) A toroidal vacuum chamber is required, of low aspect ratio. (2) A divertor is needed. (3) A cold fuel injection system is assumed. (4) Auxiliary plasma heating apparatus is required for ignition. (5) they must operate at a particular value of the product of ion density and confinement time. The differences are: (1) The induced plasma current in a Tokamak supplants the use of helical windings in the stellarator (2) Cyclic operation is necessary for Tokamaks (3) Tokamaks may require a lower β than stellarators. Difference number one could be an important advantage for Tokamaks, while difference number two may be only a small disadvantage since the duty cycle should be high. Difference three may be important. Author (NSA)

N69-23955# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
KINETIC INTERACTION OF POSITIVE-ENERGY WAVES IN A PLASMA
E. Rebhan (New York Univ.) and H. K. Wimmel Dec. 1968 27 p refs Sponsored by EURATOM
(IPP-6/72) Avail: CFSTI

Summational invariants, conservation theorems, equilibrium spectra, and the H-theorem associated with the kinetic equation for wave-wave interaction in a plasma are presented in their mutual relationship. If in some reference frame all waves have positive energies, the system always goes to equilibrium. It follows from conservation theorems that the final equilibrium state depends on the initial conditions. Regular equilibria may only occur as final states of time-varying solutions. For the three-wave case, in which only separate wave triplets are coupled, the general solution of the initial value problem is given, and it is shown that at sufficiently early times any time-dependent solution of the kinetic equation is either unphysical or degenerate. Author

N69-23956# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
OPTICAL CONSTANTS OF FULLY IONIZED PLASMAS FOR THE RADIATION OF RUBY, NEODYMIUM-GLASS, AND CO_2 LASERS
Heinrich Hora and Hannelore Mueller Nov. 1968 59 p refs Sponsored by EURATOM
(IPP-3/81) Avail: CFSTI

The refractive index and the absorption constant were numerically evaluated for fully ionized plasmas with atomic numbers Z=1 to 4 as functions of the electron temperature and atomic density. These constants were also calculated for the second harmonics of each type of radiation on the basis of the two-fluid model of hydrodynamics using Spitzer's collision frequency. Author

N69-23978# California Univ., Livermore. Lawrence Radiation Lab.
DEPENDENCE OF ION CYCLOTRON INSTABILITIES ON PARTICLE DISTRIBUTION FUNCTIONS IN THE ALICE EXPERIMENT
C. C. Damm, J. H. Foote, and A. H. Futch, Jr. 21 Jun. 1968 21 p refs Submitted for publication
(Contract W-7405-eng-48)
(UCRL-70868; CONF-680805-10) Avail: CFSTI

Measurements are given of plasma density, plasma instabilities, energy spectrum of trapped protons, and microwave heating of electrons in the Alice experiment. NSA

N69-24046# Wisconsin Univ., Madison. Dept. of Electrical Engineering.
PLASMA INSTABILITIES AND WAVES EXCITED BY AN ANISOTROPIC ENERGY DISTRIBUTION PRODUCED BY ELECTRON CYCLOTRON RESONANCE Annual Progress Report, 15 Dec. 1967–14 Dec. 1968
J. L. Shohet et al 15 Dec. 1968 66 p refs
(Contract AT(11-1)-1695)
(COO-1695-14) Avail: CFSTI

A study was made to investigate the ability of a short pulse of electron cyclotron resonance radiation to produce an anisotropic energy distribution of electrons in a plasma, and the instabilities and waves produced by this anisotropy. In particular, the nature of the rf heating mechanism and the behavior of the radiation emitted from the plasma were considered. The electron cyclotron resonance device shown was operated to obtain measurements of free–free bremsstrahlung, wall bremsstrahlung, plasma diamagnetism, energetic electron flux, and electron density in the discharge. A brush cathode gun was constructed and operated as a PIG discharge in the vacuum chamber. An aluminized scintillator and microwave interferometer were constructed and placed in the vacuum chamber to measure axial and radial particle flux. A signal averaging device was constructed and tested. An instability in the operation of the device was observed. Author (NSA)

N69-24176# Argonne National Lab., Ill.
STEAM-WATER CONDENSING-INJECTOR PERFORMANCE ANALYSIS WITH SUPERSONIC INLET VAPOR AND CONVERGENT CONDENSING SECTION
Michael A. Grolmes May 1968 131 p refs
(Contract W-31-109-ENG-38)
(ANL-7443) Avail: CFSTI

The condensing injector as a component of liquid-metal magnetohydrodynamic (LMHD) power cycles is discussed. A steam-water condensing injector with inlet vapor velocities approaching Mach 1.7 and convergent condensing section was studied. Axial pressure profiles and maximum discharge pressures were obtained for various vapor and liquid inlet conditions. Criteria for minimum liquid-vapor flowrate ratios consistent with constant-pressure condensing were verified. Details of the flow in the condensing section were obtained with gamma-ray-attenuation measurements. A relation between the inlet vapor-liquid momentum ratio and jet breakup length was determined and used to determine

the transition between analytical flow models. Two analytical formulations were employed for the distinct flow patterns and joined at the point of jet breakup. The results of this investigation were related to previous condensing-injector studies and to previous liquid-metal LMHD power cycle studies. Author (NSA)

N69-24220# Houston Univ., Tex.
ION HEATING AT THE ELECTRONIC HYBRID RESONANCE FREQUENCY
G. M. Haas and M. Eisner 1 Nov. 1968 15 p refs Presented at the Ann. Meeting of the Div. of Plasma Phys., Miami Beach, Fla.
(Contract AT(40-1)-3777)
(ORO-3777-1; CONF-681112-1) Avail: CFSTI

Significant ion heating at plasma densities up to $3 \times 10^{10}/cm^3$ was produced by resonant electric fields generated by a modulated electron beam traversing the plasma. The ion heating takes place when the plasma column is driven at one of its natural resonances--the electron-ion hybrid resonance. There are indications that ion heating can be achieved at higher densities simply by raising the modulation frequency. Author (NSA)

N69-24227# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
NON-LINEAR QUASI-NEUTRAL ELECTROSTATIC PLASMA WAVES AND SHOCK WAVES
H. Tasso Jan. 1969 12 p refs
(IPP-6/74) Avail: CFSTI

An analysis for the stationary one-dimensional Vlasov equation using quasi- neutrality instead of the Poisson equation is presented. This allows explicit solutions for the density, as a function of the potential, and proof of the positiveness of the trapped particle distribution function in a potential interval. This method is useful for oscillating waves and shock-waves. Author

N69-24228# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
PLASMA LOSSES IN A TOROIDAL THETA PINCH WITH SUPERPOSED HELICAL HEXAPOLE (n=4/3)
W. Lotz Nov. 1968 37 p refs
(IPP-1/92) Avail: CFSTI

A toroidal theta pinch discharge with superposed helical hexapole field is investigated. The characteristic data of the discharge are: major diameter 52 cm, minor inner diameter of the vacuum vessel 6.0 cm, maximum theta pinch field between 10.5 and 21 kG, rise time (quarter cycle) 3.0 μs, maximum temperature between 40 and 100 eV, maximum density between 1 and 3×10^{16} cm^{-3}, minimum plasma radii between 0.5 and 1.0 cm, beta values between 0.3 and 1.0. The pitch-angle between a hexapole wire and the minor axis is 11°, thus a hexapole wire passes 4/3-times around the minor axis when circling around the major axis once (the rotational number n equals 4/3). Plasma temperature, density, and radius turned out to be approximately the same as in the non-helical case. The plasma loss rates are determined by measuring the particle density; on the mean they are (34 ± 10)% smaller than those with non-helical hexapole and are virtually independent of the combination of parameters used. Within experimental error, the losses can be described as cusp losses with a cusp slit width of 0.54 ion gyro radii or as resistive losses with a diffusion coefficient 1.7 times the classical value. Author

N69-24287# Stanford Univ., Calif. Inst. for Plasma Research.
PARAMETRIC AMPLIFICATION OF CYCLOTRON HARMONIC WAVES IN PLASMA
K. J. Harker and F. W. Crawford Jul. 1968 68 p refs Presented at the 7th Intern. Conf. on Generation and Amplification of Microwaves and Light Waves, Hamburg
(Contract AT(04-3)-326)
(SU-IPR-253; CONF-680935-1) Avail: CFSTI

An analysis is presented of the nonlinear interaction between cyclotron harmonic waves propagating perpendicular to the static magnetic field in a warm magnetoplasma. It is demonstrated that the synchronism conditions for traveling-wave parametric amplification and passive-mode conversion, can be satisfied for such waves, and an analysis is carried out for a large-signal pump wave interacting with two small-signal waves. Growth rates and corresponding pump powers are computed, and it is concluded that the effect should be observable in typical laboratory plasmas. A discussion of possible device applications is also given. Author (NSA)

N69-24288# Stanford Univ., Calif. Inst. for Plasma Research.
EXPERIMENTAL VERIFICATIONS OF MICROSCOPIC PLASMA THEORY
F. W. Crawford Jul. 1968 38 p refs Presented at Intern. Symp. on One Particle Distribution Functions in Plasmas, Marburg, Germany, Aug. 1968
(Contracts AT(04-3)-326; DA-28-043-AMC-02041(E))
(SU-IPR-250; CONF-680830-1) Avail: CFSTI

One of the ways in which the detailed shape of the charged particle velocity distribution function is in a plasma may manifest itself in the dispersion characteristics of plasma wave propagation. Several phenomena, e.g., Landau damping, cyclotron damping, and cyclotron harmonic waves, can only be predicted from a microscopic theory of the propagation. In recent years, experimental agreement with theory based on the Vlasov equation has been demonstrated for such phenomena with a high degree of accuracy for Maxwellian plasmas, in the small-signal propagation limit. This paper reviews some of the work already carried out, and then discusses some likely future developments in the comparison of theory and experiment for situations where the small-signal approximation breaks down. Some relevant results on wave/wave interaction are described. Author (NSA)

N69-24343# Houston Univ., Tex.
ION HEATING BY INHOMOGENEOUS TIME VARYING ELECTRIC FIELDS
T. V. Lautzenhiser, M. Eisner, and G. Haas 1 Nov. 1968 13 p refs Submitted for publication
(ORO-3777-2; CONF-681112-2) Avail: CFSTI

Results of calculations of single ion dynamics, for an ion interacting with the field of a modulated electron beam in a beam formed magnetoplasma, exhibit ion heating for modulation frequencies several times the ion cyclotron frequency, as observed by Haas and Dandl. The greater the electric field gradients, the higher the frequency at which significant ion heating is calculated. Ion heating may then be useful in determining plasma dielectric properties. Author (NSA)

N69-24347# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
ARC PHENOMENA AND GASDYNAMIC EFFECTS DUE TO INTERACTION OF SHOCK WAVES WITH MAGNETIC FIELDS
H. Klingenberg Aug. 1968 42 p refs
(IPP-3/78) Avail: AEC Depository Libraries

The arc phenomena occurring on interaction of shock-heated plasma with a magnetic field were studied in order to achieve an approximately uniform current distribution in a certain volume using a number of small electrodes. This is necessary for producing plasma gas dynamic effects such as reflected shocks and one-dimensional

few behind them in order to compare experimental results with theory. The current amplitude depends on the surface area and the number of electrodes. It is governed by the complex boundary conditions in the plasma-to-electrode transition, which consists of narrow current channels leading to arc spots. The properties observed agree with those of normal arcs described in the literature. Owing to the complexity of the phenomena it is not possible to explain the results quantitatively. They can, however, be explained qualitatively by comparing them with those described in the literature on normal arcs. Author (NSA)

N69-24517# New York Univ., N. Y. Dept. of Physics.
COLLECTIVE EFFECTS AND THE SCATTERING OF ATOMIC BEAMS FROM PLASMAS
Byron Goldstein Nov. 1968 46 p refs
(Contract DAHC04-67-C-0034)
(AD-680201; TR-A68-1; AROD-4614-13-P) Avail: CFSTI CSCL 20/9

It has been established that atomic beams are useful diagnostic tools in the study of plasmas. They are well suited for certain measurements of plasma ion velocity distributions, and have been used, through attenuation experiments, to measure plasma densities and temperatures. This paper considers the possibility of extending the application of atomic beams to the detection of collective effects in laboratory plasmas. The incident beam energy, even for thermal beams, may be much greater than the energies which characterize the interacting plasma. This suggests that for a wide class of beam energies a weak binding approximation can be used to describe the scattering. In this paper, attention is confined to one such approximation - the impulse approximation. Author (TAB)

N69-24657# Tohoku Univ., Sendai (Japan). Research Inst. of Electrical Communication.
EQUILIBRIUM OF A HIGH BETA PLASMA IN A TOROIDAL MAGNETIC FIELD WITH A NON-PLANAR AXIS
Shigeo Nagao, Keiichiro Sugita, Jiro Chiba, Hiroshige Watanabe, Yukihiro Goto et al Jul 1968 11 p refs
(REIC-TR-29) Avail: AEC Depository Libraries

The optimum configuration for the equilibrium of a high-beta plasma was determined in the magnetic field with a non planar axis, which is a closed double helix. The beta value up to 100% is permitted under these conditions, where the average radius of the helix should be $R(n^2 + 1)^{-1}$, and moreover the radius should have a small periodic component with twice the pitch. Author (NSA)

N69-24669# Tohoku Univ., Sendai (Japan). Research Inst. of Electrical Communication.
MEASUREMENT ON THE PROPAGATION CONSTANTS OF A SLOW WAVE IN A PLASMA FILLED CYLINDRICAL WAVEGUIDE WITH AN AXIAL MAGNETIC FIELD
Masahiko Kihara, Shoichi Ono, and Yukio Shibata 1967 33 p refs
(REIC-TR-18) Avail: AEC Depository Libraries

An experimental device was used in which both the propagation characteristics of slow waves and the characteristics of the plasma itself could be measured simultaneously. Detailed measurements were made of the phase and attenuation constants and compared with theoretical results. The measured phase constants agreed well with the theoretical value of uniform density model, except at particular magnetic fields arising from anomalous phenomena. While the attenuation constants were compared with the simple analysis considering the electron–neutral atom collision. NSA

N69-24683# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
TOROIDAL EQUILIBRIUM WITH TEMPERATURE GRADIENTS, PART I [TOROIDALES GLEICHGEWICHT MIT TEMPERATURGRADIENTEN]
W. Feneberg Jan. 1969 32 p refs In GERMAN; ENGLISH summary
(IPP-3/84) Avail: CFSTI

A model is presented for a steady-state plasma in a toroidal magnetic field in which a temperature gradient is formed as a result of the input energy being transported to the wall by thermal conduction. There is a region where the thermal conductivity parallel to the field lines is sufficiently high to keep the temperature constant in zeroth order on a magnetic surface. In this region the energy equation can be expanded and the temperature profile can be obtained from an ordinary second-order differential equation analogous to a linear plasma column in a homogeneous magnetic field. In the toroidal case, however, the thermal conductivity is increased compared with the linear case. The density profile can be derived from a solubility condition that has to be imposed on the equation of continuity. The thermal diffusion coefficient thereby plays an important part in Ohm's law because it establishes a relation between the density and temperature gradients. Author

N69-24713# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
SOME PROPERTIES OF RELATIVISTIC PLASMA RINGS [EINIGE EIGENSCHAFTEN RELATIVISTISCHER PLASMARINGE]
Wilhelm H. Kegel Dec. 1968 39 p refs In GERMAN; ENGLISH summary
(IPP-0/1) Avail: CFSTI

In connection with the electron ring accelerator project, plasma rings are considered which consist of electrons with a relativistic mean velocity and fewer ions with a low mean velocity. Necessary conditions for such systems to be in equilibrium are investigated. From the relativistic Vlasov equation in cylindrical coordinates, moment equations are derived. Separate radial and axial virial theorems for ions and electrons are derived from the moment equations. They relate the average pressure with the integrals over the spatial moments of the electric and magnetic forces. These relations show that in general the ion pressure is anisotropic. Approximate expressions are derived for the virial integrals on the assumption of a low aspect ratio. In the case of a homogeneous external field, relations are obtained between the average pressure and the line densities of the electrons and ions. Author

N69-24728# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXCITATION OF LONGITUDINAL OSCILLATIONS OF MAGNETO ACTIVE PLASMA
V. V. Angeleiko and A. B. Kitsenko May 1968 12 p refs Transl. into ENGLISH from the Russian
(AD-680580; FTD-HT-23-4-68) Avail: CFSTI CSCL 20/9

The work investigates the excitation of longitudinal oscillations in a plasma consisting of two types of ions through which a stream of particles is moving under an arbitrary angle to the direction of the internal magnetic field. The dispersion relation for the plasma is analyzed and the relationship between its four roots is studied. In the presence of the stream, a new dispersion relation is written consisting of that for the plasma and the added term for the beam and for the interaction effects. This relationship is studied for the case of a cold stream under the conditions of Cerenkov resonance and for the case of a cold stream under conditions of anomalous Doppler effect. In addition, hot beam interaction with the plasma is briefly discussed. The instability criteria and growth rates for the various waves are given under specified relationships between the frequencies characterizing the plasma and beam systems. Author (TAB)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N69-23357 Missouri Univ., Rolla.
INVESTIGATIONS BY NEUTRON DIFFRACTION UTILIZING WHITE NEUTRON RADIATION
Arlen Ray Schade (Ph.D. Thesis) 1968 279 p
Avail: Univ. Microfilms: HC $12.60/Microfilm $3.60 Order No. 68-14693

The most probable reactor core neutron velocity was determined by analysis of data obtained from single crystals of copper and lithium fluoride. Derivation of the relationship between the maximum in experimental count rate and the most probable velocity, an error analysis of the method and the computer routine are given for the method used to obtain the most probable velocity. The most probable velocity was used to index the maxwellian distributions from polycrystalline materials. Investigations were done with white neutron radiation of various silicon steel samples of different preferred orientation. A method is described by which the preferred orientation of samples may be easily determined. This method involves analysis of maxwellian distributions and rocking crystal curves for various important sample directions, e.g., rolling direction, rolling direction + 45°, and cross rolling direction.
Dissert. Abstr.

N69-23366 Michigan Univ., Ann Arbor.
APPLICATIONS OF THE DIRECTIONAL PHONON FREQUENCY FUNCTIONS IN NEUTRON SCATTERING INVESTIGATIONS OF HIGH POLYMERS
John Edward Lynch, Jr. (Ph.D. Thesis) 1968 191 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 68-13354

The incoherent and coherent differential neutron scattering cross-sections for crystalline polymers are written in terms of the amplitude weighted, directional frequency functions. These functions describe the dependence of the cross-sections on the vibrational frequencies and displacements of the scattering nuclei. In this analysis, only phonon wave vectors directed parallel to the molecular chain axes are considered. The two phonon G-functions are also defined and the orientation averages are performed, for both unoriented and stretch-oriented long chain polycrystalline polymers. The orientation average of the Debye–Waller factor is performed separately from that of the remainder of the cross-section. The vibrational frequencies and polarization vectors, which are required for the construction of the directional frequency functions, are obtained from the solutions of the dynamical matrix equations.
Dissert. Abstr.

N69-23391 North Carolina State Univ., Raleigh.
CHARGE TRANSIENTS IN ALUMINUM-SILICON NITRIDE-SILICON CAPACITORS
Charles Leroy Hutchins (Ph.D. Thesis) 1968 174 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-14657

Capacitors were fabricated on n-type silicon substrates using thin films of silicon nitride and filament evaporated aluminum. The silicon nitride films were prepared using pyrolytic deposition of SiH_4 and NH_3 in an excess hydrogen atmosphere. The transient effects of the semiconductor surface charge in the MNS capacitors are investigated with temperature as a parameter. A theoretical model has been developed to describe this charge motion within a limited time period. This period was chosen because it is a convenient time interval for experimental measurements and the theory simplifies greatly. During this time period, the trapped charge in the insulator is being released with little or no retrapping. The theoretical model proposes two types of trap distributions with respect to energy below the conduction band in the insulator.
Dissert. Abstr.

N69-23401# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
EFFECT OF MICROSTRUCTURE ON SUPERCONDUCTIVITY IN THE COLUMBIUM–HAFNIUM SYSTEM
Richard E. Siemens, L. L. Oden, and D. K. Deardorff May 1968 33 p refs
(BM-RI-7258) Avail: Issuing Activity

A correlation of the variation of structure-sensitive superconducting properties with microstructure in selected Cb-Hf alloys and a comparison of the experimental results with those predicted by the GLAG theory are presented. Alloys in wire and rod form were evaluated by critical temperature, critical current, magnetization, resistivity measurements, and optical and electron microscopy. In the absence of an external magnetic field, the current carrying capacity of columbium was greatly reduced with addition of up to 85 wt pct Hf, but a large increase in I_c occurred for Cb-90 wt pct Hf. Favorable I_c–H behavior was observed in cold-drawn alloys containing 25 and 57 wt pct Hf. Correspondingly, a maximum in T_c occurred at 10–25 and 90 wt pct Hf. Four- or five-hour heat treatments at 600°C resulted in maximum I_c values and maximum hysteresis in magnetization. Dislocation pileup, polygonization, and fine precipitates, responsible for flux pinning, are listed in order of their effectiveness as pinning sites.
Author

N69-23407 Texas Univ., Austin.
GRAIN BOUNDARY SELF-DIFFUSION IN NICKEL
Roy Frank Canon (Ph.D. Thesis) 1968 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-16056

Computer solutions to the various mathematical analyses of the grain boundary diffusion problem have been developed and presented in a convenient manner for interpretation of grain boundary diffusion measurements using the penetration depth technique. The results allow a quantitative assessment of the limitations and applicability of two approximate solutions. These results also allow the use of an exact solution for data analysis using a simple graphical technique. The results of previous grain boundary diffusion work are reevaluated by applying the exact solution to the published penetration data. It is concluded that the activation energy for grain boundary self-diffusion in nickel along (100) symmetrical tilt grain boundaries is about 26 k-cal/g-mole and is independent of orientation. The experimental portion of this research involved the growth of high purity nickel bicrystals from the melt using an electron beam floating zone technique.
Dissert. Abstr.

N69-23409 Rutgers Univ., New Brunswick, N. J.
MAGNETIC FLUX-PENETRATION IN TYPE II SUPERCONDUCTORS
David Emil Carlson (Ph.D. Thesis) 1968 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-14243

The penetration of a small oscillating field into niobium and indium–bismuth alloys has been investigated in the presence of a steady magnetic field, which ranged from zero to above H_{c2}. Changes in the oscillating flux have been measured at frequencies of the order of one megacycle per second. Hydrodynamic theories of vortex motion, as well as theories for collective vortex oscillations, are compared with the experimental results. Under certain circumstances, the penetration depth behavior in the mixed state

can be interpreted in terms of the dc flux flow resistivity. The effects of vortex pinning are discussed. Theories for the average order parameter and the critical state of the superconducting surface sheath are compared with experiment. An extension of earlier calculations is suggested in order to determine the magnetization of thin cylindrical films and the critical state of the surface sheath. Dissert. Abstr.

N69-23414 Temple Univ., Philadelphia, Pa.
ENERGY BANDS OF PARTIALLY ORDERED STOICHIOMETRIC BINARY ALLOYS
Kang-Pei Wang (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-14156

This method is essentially a quantum mechanical perturbation method. In comparing the crystal potentials for ordered and disordered crystals it is possible to express the perturbing potential as a function of the order parameter. A quantitative calculation based on this method was made on beta brass. The wave functions for ordered beta brass were constructed using the Green's Function method at symmetry points of the Brillouin Zone and used as zero order wave functions. The gap across the cubic zone boundary and that across each face of the dodecahedral zone boundary are reduced as the system departs from order. The former is apparently related to the disappearance of the superlattice line due to the Bragg planes of reflection in the x-ray analysis of order-disorder. The latter suggests that the optical absorption edge should shift to a lower frequency as order decreases. Dissert. Abstr.

N69-23421 Pittsburgh Univ., Pa.
GRAIN BOUNDARY DIFFUSION OF GERMANIUM
David Wei-Kou Ing (Ph.D. Thesis) 1968 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-14175

The objective of the current research was to develop fundamental information on grain boundary diffusion and the growth of germanium bicrystals. Emphasis was placed on the correlation between small and large grain boundary diffusions. The results obtained could be the foundation for the development of a new generation of solid state devices. High purity and extreme cleanliness are the first requirements of any semiconductor research. Since impurities are counted in atoms, the ordinary chemical method of purification was inadequate. Germanium was zone-refined after careful chemical purification. A series of molten zones passed through the charge in one direction; impurities, travelling with or opposite to the zones, concentrated at one end or the other, thereby purifying the remainder of the charge. In order to grow bicrystals, it is necessary to have single crystals with controlled orientation as seeds. Dissert. Abstr.

N69-23474 American Univ., Washington, D. C.
A STUDY OF THE PARAMAGNETIC SUSCEPTIBILITIES FOR MANGANOUS FLUORIDE
Ronald Lee Kligman (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-14102

Manganous fluoride, a uniaxial magnetic insulator, has been thoroughly studied, and its physical and chemical properties are well determined. Among them is the magnetic anisotropy which, for the most part, is considered to be dipolar in origin. Utilizing this and certain low temperature physical constants one calculates the high temperature paramagnetic susceptibilities using the cluster variation theory. In the present study the theory is restricted to two spin clusters. Higher order correlations are ignored. Measurable effects on the susceptibilities are observed for various combinations of two body correlations, associated with different neighbors about a particular lattice site in the crystal. Indications imply a need to consider higher order correlations, i.e., three spin clusters and so on. Dissert. Abstr.

N69-23517 Colorado Univ., Boulder.
THE TEMPERATURE DEPENDENCE OF THE FLUORINE NUCLEAR SPIN-LATTICE RELAXATION TIME IN ANTIFERROMAGNETIC COBALT FLUORIDE
Albert William Bevan, Jr. (Ph.D. Thesis) 1968 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-14386

The temperature dependence was determined experimentally in the temperature range 4° to 16°K in zero applied magnetic field. A strong temperature dependence was observed, with the relaxation time becoming longer as the temperature was lowered. The relaxation time was measured by observing the exponential rise in the fluorine nuclear magnetization following saturation by an rf picket fence. Spin echo techniques were used to observe the nuclear magnetization signal, and a single exponential recovery of the spin system was found. The temperature dependence was also determined theoretically. Linear spin wave theory was used, and an expression for the relaxation rate was obtained. The theoretical curve agreed with the experimental data over a range of values for the relaxation rate of six orders of magnitude, with the theoretical temperature dependence being a little steeper at the higher temperatures. Dissert. Abstr.

N69-23563*# Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
STUDY OF ROLLING-CONTACT PHENOMENA IN MAGNESIUM OXIDE
K. F. Dufrane and W. A. Glaeser 14 Apr. 1969 30 p refs
(Contract NAS3-6263)
(NASA-CR-72530; TSR-2) Avail: CFSTI CSCL 20L

Basic phenomena associated with rolling-contact deformation were studied in MgO single crystals deformed by a rolling hardened steel ball to avoid the complications of inclusions, grain boundaries, and mutiple phases existing in normal bearing alloys. Examination of thin films from the rolling-contact tracks by transmission electron microscopy revealed that changes in dislocation density and interaction were responsible for measured variations in track width and hardness. The presence of adsorbed toluene on the surface caused a change in slip mode and premature spalling similar to previous results with oil. The effect of adsorbed fluids on slip mode is probably caused by their influence on dislocation mobility. High-speed elastohydrodynamic rolling produced slip in narrow bands across the contact track, which is caused by the initiation of dislocations only at subsurface sites. Continued rolling caused the bands to widen and eventually cover the entire track width. The cause for fatigue spalls in MgO may be related to fatigue failures in real bearing materials. Author

N69-23574 Temple Univ., Philadelphia, Pa.
EPR OF TRIVALENT Ru IN YTTRIUM GALLIUM GARNET AND YTTRIUM ALUMINUM GARNET
Irvin Alexander Miller (Ph.D. Thesis) 1968 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-14144

In ionic crystals containing a trigonally-distorted octahedral site, the trigonal field strength is one of the parameters which markedly influences the spectral behavior of substituted transition metal ions. For the corundum lattice, however, there is uncertainty about the sign of the trigonal field, as revealed by EPR data for the various ions. The data for the d^2, d^7, and low spin d^5 ions show a positive field, while a negative field is indicated by the d^3 ion results. One of the possible explanations of this inconsistency is that the different ions may be displaced from the Al^{3+} site, which is permitted by the lack of inversion symmetry. To eliminate this possibility, we chose the garnet lattice, which has a trigonally-distorted octahedral site with inversion symmetry. EPR data at 4.2°K were obtained for Ru^{3+} in the octahedral sites of yttrium gallium garnet (YGaG) and yttrium aluminum garnet (YAlG). Dissert. Abstr.

N69-23581 Colorado Univ., Boulder.
SHIELDING AND MAGNETIC FIELD EFFECTS ON HYDROGEN-LIKE IMPURITY LEVELS IN N-In-Sb
Paul Berrick Abramson (Ph.D. Thesis) 1968 65 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-14366

The effect of conduction band electron gas shielding on bound electrons in donor levels in InSb in the presence of magnetic fields is investigated using the effective mass theory. It is assumed that all impurities except one are ionized and the unionized impurity is treated as if it were a hydrogenic atom immersed in a medium of uniform dielectric constant. Its outermost bound electron is given an effective mass equal to that of the minimum of the conduction band in InSb. The shielding in this hydrogenic atom by the conduction electron gas is determined by finding the conduction band electron wave functions at given energy values in the presence of the unionized impurity, the rest of the conduction band electron gas, and the magnetic field. Dissert. Abstr.

N69-23619# California Univ., Berkeley. Lawrence Radiation Lab.
CRITICAL TEMPERATURE OF Nb_3Sn IN VARIOUS MICROSTRUCTURES
Roger Goolsby (M.S. Thesis) Sep. 1968 51 p refs
(Contract W-7405-ENG-48)
(UCRL-18452) Avail: CFSTI

The effects of process variables on the microstructural distribution and critical temperature (T_c) of Nb_3Sn were studied. By utilizing two preparation techniques, it was possible to prepare samples whose microstructures consisted of a Nb_3Sn film network surrounding a second phase of either niobium or NbC. The critical temperature of a sample with such a network was approximately the same as that for bulk Nb_3Sn. One preparation technique consisted of sintering niobium, tin, and carbon powders, while the other technique consisted of impregnating a porous niobium powder compact with liquid tin and reacting to form a Nb_3Sn film network at the niobium–tin interface. The critical temperatures of the samples were varied systematically by change of process variables, with T_c values ranging from 15.9 to 17.8°K. For samples prepared by the sintering process, a linear relationship was observed between upper critical field and critical temperature. Efforts were made to refine the microstructure by obtaining a very thin Nb_3Sn film network. Author (NSA)

N69-23727# Carnegie-Mellon Univ., Pittsburgh, Pa.
REORDERING DIFFUSION PROCESSES IN AMORPHOUS FILMS OF Ge–Mg_3Sb_2
Salvatore Rocco Pansino (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-10711

Germanium Mg_3Sb_2 were vapor deposited in various proportions in a high vacuum. The films as deposited were amorphous. Subsequent heating resulted in an ultrafine grained structure. Conductivity measurements, which were used to observe the annealing process, indicate two distinct annealing modes. A sudden, almost discontinuous, change in the conductivity occurred over a very narrow temperature interval. The annealing behavior of the films above this temperature differed drastically from that observed at lower temperatures. In the low temperature region, the conductivity decreased on annealing, while in the high temperature region, the conductivity increased on annealing. Electron microscope studies indicate that the annealing behavior above the transition temperature interval is associated with extensive grain growth. Dissert. Abstr.

N69-23773 Duke Univ., Durham, N. C.
SUPERCONDUCTIVITY IN SEMICONDUCTORS
Daniel Wayne Deis (Ph.D. Thesis) 1968 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-14301

The construction of an apparatus employing the technique of adiabetic demagnetization capable of reaching temperatures in the milli-degree region, and its use in the investigation of superconductivity in low carrier density materials (10^{20} to 10^{21} carriers per cc.) are described. Measurements of the superconducting transition temperatures of both self and impurity-doped tin telluride were made down to lower temperatures and lower carrier densities than had previously been achieved. In self-doped tin telluride superconductivity was found in six samples having carrier densities in the range 14.2×10^{20} to 5.06×10^{20} carriers per cc. In arsenic and antimony-doped tin telluride six samples having carrier densities between 10.9×10^{20} to 5.08×10^{20} carriers per cc. exhibited superconductivity. Transitions were also found in two samples of self-doped germanium telluride. Impurity-doped lead telluride and Bi_2Te_3 were investigated but superconductivity was not exhibited by either compound down to 0.0138°K and 0.0188°K, respectively. Dissert. Abstr.

N69-23775 Rensselaer Polytechnic Inst., Troy, N. Y.
THE SOLID-SOLID INTERFACE AND REAL AREA OF CONTACT
Michael Joseph Furey (Ph.D. Thesis) 1968 337 p
Avail: Univ. Microfilms: HC $15.30/Microfilm $4.35 Order No. 68-13509

An experimental investigation of the real area of contact between solids was made using a new device developed for studies on the physics and chemistry of solid-solid interfaces. The apparatus consists of a fixed specimen (e.g., a metal sphere) loaded against a transparent plate such as an optical flat. The plateaus of contact for both reflective and transparent specimens can be observed and photographed on a macro- as well as microscale by means of vertical illumination. The device includes provisions for varying the normal and tangential loads independently, for repeated traverse sliding action, and for friction or tangential force measurements under conditions of ambient or controlled atmosphere. Studies were carried out to determine the influence of the following variables on the nature and size of the contact region: contact time, composition of the solid, normal load, tangential load, sliding contact, and surface treatment. Dissert. Abstr.

N69-23889# Bhabha Atomic Research Centre, Bombay (India). Chemistry Div.
A NOTE ON THE SEMI-EMPIRICAL THEORY OF DILUTE NON-MAGNETIC ALLOYS
C. Manohar 1968 12 p refs
(BARC-382) Avail: CFSTI

A mathematical discussion is presented on the development of a semiempirical method based on the perturbation theory for alloys whose solute valence differs from that of the solvent. Residual resistivity and Friedal oscillation data are tabulated, and concentration data are tabulated. NSA

N69-23925# California Univ., Berkeley. Lawrence Radiation Lab.
ORIENTATION EFFECT ON THE PLASTIC DEFORMATION BEHAVIOR OF MOLYBDENUM SINGLE CRYSTALS AT LOW TEMPERATURES
Chih-An Liu (M.S. Thesis) Mar. 1968 32 p refs
(Contract W-7405-ENG-48)
(UCRL-18063) Avail: CFSTI

Single crystals of Mo oriented near the [111][011] edge in the standard stereographic projection triangle were tested in

tension at different temperatures from 20° to 600°K at a strain rate of 1.31×10^{-4} sec^{-1}. The results were compared with the data from deformation of Mo single crystals oriented at the center of the standard stereographic projection triangle for (T01)[111] single slip. Below about 440°K, the flow stress depends strongly on both the temperature and orientation. Experimentally determined activation volumes showed very good agreement with the Peierls mechanism but the activation energies did not. Analyses of the results revealed that the Dorn–Rajnak model of the Peierls mechanism may be reconstructed for dislocation core energies so as to explain the observed asymmetric behavior of single crystals of bcc metals. Analyses of the deformation traces show that specimens tend to slip crystallographically on the (T01) planes at low temperatures. The slip lines increase in waviness as the temperatures are increased. The slip direction is always consistent with the [111] direction for all temperatures. Author (NSA)

N69-23946# California Univ., Livermore. Lawrence Radiation Lab.

LARGE SUPERCONDUCTING MAGNETS

Carl D. Henning 25 Jun. 1968 20 p refs Presented at the 4th Ann. Cryog. Exposition and Technol. Symp., Chicago, 1968

(Contract W-7405-ENG-48)

(UCRL-71077; CONF-680622-1) Avail: CFSTI

Materials available for use as type-II superconductors, their stabilization against electrodynamic transients, and the design and performance of large magnets are reviewed briefly. A tabulation of the characteristics of some specific large superconducting magnets is included. NSA

N69-24004# Hewlett-Packard Co., Palo Alto, Calif.

INVESTIGATION OF SEMICONDUCTOR SCHOTTKY BARRIERS FOR OPTICAL DETECTION AND CATHODIC EMISSION Final Report, 15 Nov. 1967–14 Nov. 1968

Jerome Cohen, Juri Vilms, and Robert J. Archer Dec. 1968 133 p refs

(Contract F19628-68-C-0090)

(AD-682522; AFCRL-68-0651) Avail: CFSTI CSCL 20/12

This is the final report of a one-year project to explore two new applications of metal-semiconductor diodes. The phenomena investigated are cathodic emission into vacuum and photoemission into semiconductors. They are intended, respectively, to be the basis of the development of cold cathodes and infrared photo-detectors. Author (TAB)

N69-24047# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

DEGRAPHITIZATION UNDER THE EFFECT OF NEUTRON IRRADIATION [PROCESSUS DE DEGRAPHITATION SOUS L'EFFET DES RAYONNEMENTS NEUTRONIQUES]

G. Micaud, J. Rapeneau, A. Pacault (Bordeaux Univ.), and A. Marchand (Bordeaux Univ.) 1968 40 p refs In FRENCH; ENGLISH summary Presented at the 18th Ann. Meeting on Carbonization and Graphitization, Paris

(CEA-CONF-1045; CONF-680620-3) Avail: AEC Depository Libraries

In order to study the effects of neutron radiation on the electrical and magnetic properties of a polycrystalline nuclear graphite, samples were irradiated at doses increasing to 8.5×10^{21} neutrons/cm^2 and at four different temperatures: 85, 150, 200, and 280°C. The electrical resistivity, Hall effect, magnetoresistance, magnetic susceptibility, and electronic paramagnetic resonance of these samples were measured at 300°K in order to study the variation of these properties as a function of dose and at different temperatures. Certain of these samples, irradiated under quite different dose and temperature conditions, were heat-treated and examined in the course of annealing. The analogy between the curves thus obtained and those plotted during graphitization of the same material suggests that the effect of neutron radiations may resemble a "degraphitization" process. Author (NSA)

N69-24139# AEG-Telefunken, Ulm (West Germany).

DIFFUSION OF SODIUM IN THIN FILMS OF PURE, BORON-DOPED AND PHOSPHORUS-DOPED SILICON DIOXIDE [DIFFUSION VON NATRIUM IN DUENNEN SILIZIUMDIOXIDSCHICHTEN, BOR- UND PHOSPHORGLAESERN]

I. Fraenz and W. Langheinrich Oct. 1968 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.

(BMwF-FBW-68-70) Avail: CFSTI

Sodium-absorption of thermally oxidized silicon wafers with a pure or doped silicon dioxide layer was investigated. Diffusion profiles of sodium in silicon dioxide were determined. Experiments on the diffusion of sodium into boron trioxide and phosphorus pentoxide doped oxide layers and on diffusion of phosphorus pentoxide or boron trioxide into sodium-doped silicon dioxide layers are being described. Neutron activation analysis and tracer techniques were used as methods of investigation. Author (ESRO)

N69-24301# Sperry Rand Research Center, Sudbury, Mass.

RESEARCH DIRECTED TOWARD EXCITATION OF MAGNETOACOUSTIC WAVES AT MICROWAVE FREQUENCIES Final Report, 1 May 1967–31 Jul. 1968

John R. Shane, Herbert Matthews, Herman Van de Vaart, and Michael Kestigian Aug. 1968 103 p refs

(Contract F19628-67-C-0346)

(AD-680410; SRRC-CR-68-38; AFCRL-68-0449) Avail: CFSTI CSCL 20/12

The instability threshold has been derived for several processes involving transversely pumped magnetoelastic waves in YIG. The resonance properties of FeF3 have been studied at 70 GHz. The spin configurations and resonance frequencies for a two-sublattice model of a canted orthorhombic antiferromagnet have been examined. Unstable spin waves have been parametrically excited by transverse phonons travelling in a Ga-YIG cylinder and sphere. Scattering of magnetoelastic modes by a free boundary was analyzed. Author (TAB)

N69-24309# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

NUCLEAR MAGNETIC AND QUADRUPOLE INTERACTIONS IN GARNETS

Roger Henry Tancrell Sep. 1968 227 p refs

(Contracts N00014-67-A-0298-0006; N00014-67-A-0298-0005; N00014-A-67-028-0008)

(AD-680606; TR-572) Avail: CFSTI CSCL 20/12

The nuclear magnetic and quadrupole fields in the garnet structure are studied. NMR measurements are made on the Ga71 and Ga69 isotopes in diamagnetic YGaG and in ferrimagnetic Ga-doped YIG. NMR measurements are also made on Al27 in diamagnetic YAIG. The gallium NMR was measured in single crystal samples of ferrimagnetic Ga-doped YIG. The local field, linewidth and relaxation times are reported. The resonance at the gallium sites is shown to be an interesting example of the local mode resonance associated with an array of spins containing a defect spin. The linewidth is found to be very broad, mainly because of interactions between the impurity sites. The various mechanisms for nuclear relaxation in magnetic materials is reviewed. Author (TAB)

N69-24328# Wisconsin Univ., Madison.

HELICONS AND NON-RESONANT CYCLOTRON ABSORPTION IN InSb and $Hg_{1-x}Cd_xTe$

John D. Wiley (Ph.D. Thesis) Wright-Patterson AFB, Ohio ARC Oct. 1968 306 p refs

(Contract AF 33(615)-5427)

(AD-680466; ARL-68-0190) Avail: CFSTI CSCL 20/12

The report describes techniques of experiment and analysis for using microwave helicon interferometry and non-resonant cyclotron absorption to determine the carrier densities, effective masses, mobilities and lattice dielectric constants for certain semiconductors and semimetals. Author (TAB)

N69-24336# Addis Translations International, Woodside, Calif.
LUMINESCENCE OF TRACE RARE-EARTHS INTRODUCED INTO YTTRIUM OXYSULFIDE
R. Ozawa 1968 17 p refs Transl. into ENGLISH from Oyo Butsuri (Tokyo), no. 37, 1968 p 80–84 Supported by UCRL, Livermore
(UCRL-Trans-10259) Avail: CFSTI

The fluorescent characteristics of Y_2O_2S crystals doped with traces of rare earths were investigated in the uv and visible regions, with emphasis on the green fluorescence. The doping ions studied included Pr^{3+}, Eu^{3+}, Tb^{3+}, Er^{3+}, and Tm^{3+}. The fluorescence was influenced by the Tb^{3+} present as impurity. NSA

N69-24337# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
COOLED AND HOT ELECTRONS IN A STRONG MAGNETIC FIELD
B. Magnusson Griffiss AFB, N. Y. RADC Jul. 1968 22 p refs
(Contract AF 61(052)-895)
(AD-680469; RADC-TR-68-587; SR-24) Avail: CFSTI CSCL 20/12

The electron temperature and electron current as a function of the applied electric field in a semiconductor in a magnetic field are computed for optical phonon scattering and taking into account the three lowest Landau-levels. The decrease of electron temperature below the lattice temperature, electron cooling, is shown to be much stronger in a magnetic field than in its absence. The tendency to current saturation which occurs in polar materials is shown to be more pronounced in a magnetic field. Acoustical phonon- and ionized impurity scattering in strong magnetic field are qualitatively discussed. Author (TAB)

N69-24341# Westinghouse Electric Corp., West Mifflin, Pa.
INVESTIGATION OF THE ACTIVE CRYSTAL LENGTH IN THE YIELD REGION OF NEUTRON-IRRADIATED COPPER SINGLE CRYSTALS. 2: THE ACTIVE CRYSTAL LENGTH
H. Neuhaeuser 1968 21 p refs Transl. into ENGLISH from Phys. Status Solidi (Frankfurt), no. 27, 1968 p 281–290
(WAPD-Trans-100) Avail: CFSTI

The active crystal length measured by a cinematographic method in the yield region of neutron-irradiated copper single crystals at various deformation rates (cross-head speeds $\dot{l} = 2 \times 10^{-6}$ to 4×10^{-2} mm/sec), temperatures (90 to 360°K), and irradiation doses (5×10^{17} to 7×10^{18} n/cm²) varies from $l_a = 20$ to 2,000 Å. At a fixed dose and a fixed temperature, the active crystal length increases with the strain rate $\dot{\varepsilon}$ and the deformation rate $\dot{l}$ is observed for $\dot{l} \geq 10^{-4}$ mm/sec. At a fixed deformation rate $\dot{l}$, the strain rate $\dot{\varepsilon}$ varies with the temperature as well as with the dose; l_a decreases with increasing temperature and increasing dose. The dependencies are discussed qualitatively. Author (NSA)

N69-24429# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.
OBTAINING MONOCRYSTALS OF SOLID SOLUTIONS OF BARIUM STRONTIUM TITANATES AND THEIR DIELECTRIC AND OPTICAL PROPERTIES
A. L. Khodakov et al Nov. 1968 12 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 108, no. 5, 1956 p 825–828
(AD-680311; PA-TT-143) Avail: CFSTI CSCL 20/2

In this paper monocrystals of solid solutions of barium and strontium titanates are described. The growing of the monocrystals was done in a platinum crucible from a solution of a mixture of barium and strontium titanates in potassium fluoride. The potassium fluoride was evaporated at the crystallization temperature of the solid solution and then slowly cooled down to the temperature of complete solidification. This method is based on the investigations of the crystallization surface of the system K2F2 - SrTiO3 - BaTiO3 performed at our institute at up to 1100C by the visual and polythermic method of fusibility. Because of the low solubility of the strontium and barium titanates as well as their solid solutions in potassium fluoride it was only possible to investigate a small part of the system. From electrical, optical, and X-ray data the conclusion can be drawn that obtained monocrystals of an uninterrupted series of solid solutions were obtained. Author (TAB)

N69-24439*# Hughes Research Labs., Malibu, Calif.
DEVELOPMENT OF ION IMPLANTATION TECHNIQUES FOR MICROELECTRONICS
R. G. Hunsperger, H. L. Dunlap, and O. J. Marsh Cambridge, Mass. NASA. Electronics Research Center Oct. 1968 61 p refs
(Contract NAS12-124)
(NASA-CR-86142) Avail: CFSTI CSCL 20K

Investigations of implantation in gallium arsenide and silicon carbide for fabricating active devices in high bandgap materials for high temperature operation are reported. The GaAs studies centered on surface protection techniques, the formation of n-type layers and of semi-insulating layers in implanted diodes, and emission spectra of implanted electroluminescent diodes. Hall measurements on zinc- and cadmium-implanted GaAs and measurements of the anneal behavior of ion implanted damage in GaAs were also made. Donor and acceptor implantations in alpha and beta SiC were made and examined, and substantial improvements in making electrical contacts are reported. Several etching methods for preparing SiC crystal surfaces are described. N.E.N.

N69-24445# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
GROWTH OF CRYSTALS BY CENTRIFUGATION
Paul J. Shlichta and Robert E. Knox Sep. 1968 28 p refs Rv Res. Commun. No. 71
(AD-680675; Douglas-Paper-5284) Avail: Issuing Activity CSCL 20/2

When a solution is rotated in a centrifuge, the solute ions, being denser than the solvent, tend to concentrate toward the outer edge of the cell. If the solution is initially near saturation, then the outer portions of the redistributed solution become supersaturated and crystal growth can occur. Under these conditions, many of the difficulties usually encountered in growing single crystals, such as dirt particles, air bubbles, or spurious seed crystals formed by evaporation at the solution surface, tend to be minimized or eliminated. On the other hand, there is some danger of crystal deformation due to the high force fields involved. Observations of crystal growth by centrifugation can also be used to measure several crystal growth parameters. Measurements of the threshold centrifugal field for crystallization of unseeded solutions can provide improved data on the supersaturation required for homogeneous nucleation. Determinations of the equilibrium form of the crystal at high g values can provide hitherto unobtainable measurements of crystal surface energy. Preliminary experiments have demonstrated the essential feasibility of these techniques, but numerous experimental difficulties must be overcome before usable crystals can be produced or accurate measurements made. Author (TAB)

N69-24448# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
THEORY OF SOLID HELIUM
Richard D. Etters Oct. 1968 15 p refs *Its* Res. Commun. No. 73
(AD-680674; Douglas-Paper-5283) Avail: Issuing CFSTI CSCL 20/12

The report discusses a theory which may be used to investigate the low-temperature properties of solids with large zero-point motion (commonly identified as quantum solids). Author (TAB)

N69-24469# Cincinnati Univ., Ohio.
HIGH TEMPERATURE THERMAL EXPANSION OF URANIUM DIOXIDE AND THORIUM DIOXIDE Technical Report, Jul. 1967–Jul. 1968
M. Hoch and A. C. Momin Wright-Patterson AFB, Ohio AFML Oct. 1968 25 p refs
(Contract F33615-67-C-1565)
(AD-680052, AFML-TR-68-219) Avail: CFSTI CSCL 20/2

The thermal expansion of uranium dioxide and thorium dioxide has been measured between 20 and 2100C using high temperature X-ray diffraction techniques. The thermal expansion of UO2 and ThO2 as measured by x-ray diffraction is identical to that obtained by bulk expansion measurements. Because of this, and because the specific heat of UO2 shows a rapid increase above 1700C indicating a disorder, it must be concluded that the major structural defect is a Frenkel type disorder. This probably involves the oxygen atom moving from the tetrahedral into an empty octahedral position. Author (TAB)

N69-24477# Technische Hochschule Munchen (West Germany).
EXPERIMENTAL INVESTIGATION OF NON-OHMIC CONDUCTIVITY IN WEAK CONDUCTIVE TO SELF-CONDUCTIVE SILICON WITH HIGH ELECTRIC FIELD STRENGTH [EXPERIMENTELLE UNTERSUCHUNG DER NICHTOHMSCHEN LEITFAEHIGKEIT VON SCHWACH- BIS EIGENLEITENDEM SILIZIUM BEI HOHEN ELEKTRISCHEN FELDSTAERKEN]
Ferdinand Nibler (Ph.D. Thesis) 1968 105 p refs In GERMAN
Avail: CFSTI

Effects of electrical field intensity on silicon conductivity are studied by comparing carrier mobility with carrier concentration at various electrical field strengths and temperatures. Results show that silicon conductivity decreases with increased field strength at about 10^3 V/cm; current density increases slowly at the same time and reaches saturation at 10^4 C/cm. It is concluded that electron-phonon scattering determines the conductivity since critical field strength diminishes at lower temperatures and carrier concentration does not affect conductivity. Transl. by G.G.

N69-24487# Stanford Univ., Calif. Microwave Lab.
INTERACTION OF MICROWAVES WITH MATTER Final Technical Report
B. A. Auld, D. Winslow, D. Wolkerstorfer, and J. Murry Oct. 1968 33 p refs
(Contract AF 49(638)-1429)
(AD-680044; ML-1697; AFOSR-68-2832) Avail: CFSTI CSCL 20/12

The program has been concerned broadly with parametric interactions in solids. The motivation for studying these interactions has always been their applicability to amplification and frequency conversion. However, the systems which have been studied here differ from those involved in the more standard and familiar parametric devices in both the kinds of interactions and the physical types of waves which are involved. This work has led to the experimental verification of several original techniques for processing microwave signals and to some new measurement techniques. In addition, acoustic properties of some new materials have been measured, traveling spin wave amplification has been of electron-phonon interactions in InSb. Author (TAB)

N69-24558# Ohio State Univ. Research Foundation, Columbus.
RESPONSE OF A LARGE SYSTEM TO A TIME DEPENDENT EXTERNAL FIELD OF ARBITRARY STRENGTH Final Report
Jan Korringa and C. C. Snug Feb. 1968 7 p refs
(Grant AF-AFOSR-869-65)
(AD-680047; AFOSR-68-2886) Avail: CFSTI CSCL 20/12

The report gives a brief summary of papers submitted under this contract in the areas of magnetism, superconductivity, and nuclear magnetic resonance. TAB

N69-24562# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
ANNUAL TECHNICAL REPORT ON MATERIALS RESEARCH, 16 SEPTEMBER 1967–15 SEPTEMBER 1968
Jan. 1969 270 p refs
(Contract ARPA SD-90)
(AD-680623) Avail: CFSTI CSCL 11/7

Materials research conducted at the Massachusetts Institute of Technology includes: Solid state and molecular theory group: Non-equilibrium quantum statistical mechanics; Atomic resonance and scattering; Neutron diffraction and neutron physics studies; The spectroscopy of light scattered from thermal fluctuations in liquids, solids, and gases; Optical spectroscopy of magnetic solids near the critical point; Light scattered from excitations in helium4 and helium3-helium4 mixtures; Order-disorder phenomena; Crystal and surface structure investigations by X-ray, neutron and electron diffraction; Molecular crystals; Electronic, magnetic, and optical properties of materials and device applications; Superconductivity theory; Semiconducting materials and devices; Microwave and quantum magnetics; Physics of solids; Physical metallurgy; High temperature metallurgy; Electronic materials laboratory; Superconductive materials; Polymers and glasses; Metals processing - casting and solidification; Plastic deformation and strain hardening; Mechanisms of fatigue damage in semi-brittle materials at elevated temperatures; Mechanics and physics of damage in heterogeneous materials; Microstructure and mechanical properties of cementitious materials; and Heterogeneous catalysis. TAB

N69-24588# California Univ., Berkeley. Dept. of Physics.
ELECTRONIC STRUCTURE OF METALS Final Scientific Report, 1 May 1963–1 Oct. 1967
Arthur F. Kip Jun. 1968 7 p
(Grant AF-AFOSR-0290-63)
(AD-680046; AFOSR-68-2884) Avail: CFSTI CSCL 20/12

During the approximate 4-1/2 years of this AFOSR Grant, research activities have been largely confined to the study of conduction electron behavior in metals. These studies included the investigation of effective masses of electrons in cyclotron resonance, some new cyclotron resonance phenomena, the first studies of electron relaxation times by means of cyclotron resonance, the design of an improved eddy current method for measuring the resistivity of metal specimens, and some measurements of flux jumping in type 2 superconductors. Author (TAB)

N69-24594# North Carolina State Univ., Raleigh. Dept. of Nuclear Engineering.
EFFECT OF RADIATION AND GAS CONCENTRATION ON RARE GAS DIFFUSION IN SOLIDS Annual Progress Report, 1 Nov. 1967–31 Oct. 1968
Thomas S. Elleman 1 Nov. 1967 68 p refs
(Contract AT(40-1)-2508)
(ORO-3508-4) Avail: CFSTI

Diffusion of ^{133}Xe in CsI was studied as an aid to understanding rare gas diffusion in more complex systems, such as nuclear reactor fuels. Diffusion at low gas concentrations and negligible radiation damage levels was measured by growing single crystals of CsI containing ^{133}I which decayed to ^{133}Xe. Both the time rate of release and temperature dependence of the rare gas diffusion coefficient were consistent with classical diffusion solutions. Crystals containing high concentrations of defects exhibited rare gas trapping and anomalous diffusion kinetics. Trapped gas tended to stabilize defects and prevent annealing during heating. Diffusion of fission gas recoiled into CsI specimen surface layers from an external fissionable source obeyed classical diffusion solutions at low fission recoil concentrations, while at high concentrations, radiation damage created traps which decreased gas diffusion rates. Author (NSA)

N69-24642# Brandeis Univ., Waltham, Mass. Dept. of Physics.
THEORETICAL RESEARCH IN STATISTICAL MECHANICS Final Report, 1 Dec. 1966–30 Jun. 1968
S. Schweber 30 Jun. 1968 7 p refs
(Contract Nonr-1677(04))
(AD-680653) Avail: CFSTI CSCL 20/12

The report describes the general areas of research done under the contract, and it lists the personnel, publications, and reports involved with the grant. TAB

N69-24680# Northwestern Univ., Evanston, Ill. Materials Research Center.
MATERIALS RESEARCH CENTER, NORTHWESTERN UNIVERSITY, 1968 Annual Report, 1 Oct. 1967–30 Sep. 1968
Sep. 1968 178 p refs
(Contract SD-67)
(AD-680448; AR-9) Avail: CFSTI CSCL 11/7

The Annual Report for 1968 is a condensed account of the research activities of all members of the Materials Research Center at Northwestern. Presented herein are the summaries of research progress prepared by the individual faculty members; these are arranged in alphabetical order by author, include a list of invited talks and publications stemming from the research and the names of post-doctoral research associates and graduate students affiliated with each project. Author (TAB)

N69-24732# Pennsylvania State Univ., University Park. Materials Research Lab.
NONLINEAR ELASTIC AND THERMOELASTIC PROPERTIES OF HIGH TEMPERATURE MATERIALS Annual Progress Report
G. R. Barsch Dec. 1968 9 p
(Contract AT(30-1)-3991)
(NYO-3991-2) Avail: CFSTI

The pressure dependence of the three second-order elastic constants were measured for single crystals of RbCl, RbBr, and RbI at 300°K. The measurements were restricted to the pressure range below the phase transition from the NaCl to the CsCl structure. Similar measurements were performed for CsI. Methods are being considered for experimental determination of fourth-order elastic constants. Ultrasonic equations of state were calculated. NSA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N69-23884*# Thiokol Chemical Corp., Denville, N. J. Reaction Motors Div.
VACUUM IGNITION CHARACTERISTICS OF FLOX/DIBORANE AND OXYGEN DIFLUORIDE/DIBORANE Interim Final Report, 15 Feb.–15 Oct. 1968
G. R. Mistler and T. F. Seamans Mar. 1969 79 p refs
(Contract NAS7-660)
(NASA-CR-100678; RMD-5534-FI) Avail: CFSTI CSCL 21I

The vacuum ignition characteristics of Flox/diborane and OF_2/diborane were investigated in 100 lb thrust rocket engines to determine potential problem areas and define design concepts required to insure reliable vacuum starting of space engines. Parameters investigated were: oxidizer (Flox and OF_2); hardware temperature (70°, 0°, −100° and −200°F); propellant temperature (Flox at −320°F, OF_2 at −320° and −160°F, diborane at −100° and −10°F); propellant lead/lag; design chamber pressure (20 and 100 psia); and injector configuration/dribble volume (9 pair doublet and 1 pair doublet). Pressure fluctuations in the oxidizer manifold were common and are apparently caused by both fuel and combustion residue contaminating the oxidizer manifold. Shortest ignition delay times were obtained with Flox rather than OF_2, with the single element injector, the 100 psia chamber and no propellant lead. Unexpectedly, neither hardware temperature nor propellant temperature affected ignition delay times. The dominant ignition reactions of these propellants appear to be gas phase reactions in the engines. Author

N69-24070# Rocket Propulsion Establishment, Westcott (England).
PERCHLORIC ACID FLAMES. PART 9: A TWO-FLAME STRUCTURE WITH HYDROCARBONS
A. R. Hall and G. S. Pearson Mar. 1968 22 p refs
(RPE-TR-68/4) Avail: CFSTI

Premixed flames of perchloric acid with methane have been found to exhibit a two-flame structure under certain conditions. A similar, more diffuse structure is apparent in perchloric acid flames containing less diluent or with other hydrocarbons. This provided an opportunity to investigate the chemical action of the acid. Burning velocities, spectra, temperatures and burned gas compositions have been measured for flames with methane as fuel. The product analyses indicate that the second flame results from the combustion of carbon monoxide and of a smaller amount of hydrocarbon, which are not oxidized in the first flame. It is concluded that the two flame fronts are the result of the dual oxidizing action of the perchloric acid in producing both a chlorine-oxygen species, which reacts rapidly with the initial fuel molecule, and oxygen, which completes the combustion. The relevance of this finding to other properties of perchloric acid flames is discussed. Author (ESRO)

N69-24132# Rocket Propulsion Establishment, Westcott (England).
COMBUSTION INSTABILITY OF SOLID PROPELLENTS: EFFECT OF OXIDIZER PARTICLE SIZE, OXIDIZER/FUEL RATIO AND ADDITION OF TITANIUM DIOXIDE TO PLASTIC PROPELLENTS
R. D. Gould May 1968 40 p refs
(RPE-TR-68/1) Avail: CFSTI

The effect of variations in the composition of solid propellents on their tendency to show combustion instability at 1000 psi (6895 kN/m^2) has been investigated using the T burner. It has been shown that ammonium perchlorate particle size can have a large effect on the acoustic response and that this is frequency-dependent. Titanium dioxide is usually added to plastic propellents to promote stable combustion and the mechanism of its action has been determined. With a view to the potential use of oxygen-balanced propellents the effect of varying the oxidizer/fuel ratio of plastic propellents has also been studied. Author (ESRO)

N69-24207*# Florida Univ., Gainesville. Dept. of Mechanical Engineering.
PREDICTION OF EXPLOSIVE YIELD AND OTHER CHARACTERISTICS OF LIQUID PROPELLANT ROCKET EXPLOSIONS Final Report
E. A. Farber, F. W. Klement, and C. F. Bonzon 31 Oct. 1968 424 p refs
(Contract NAS10-1255)
(NASA-CR-100782) Avail: CFSTI CSCL 21I

Methods by which the explosive hazards of liquid propellant rockets can be assessed and explosive yield predicted are discussed. Investigation reported upon is divided into four parts: (1) development of a mathematical model to satisfy the presently available experimental information and statistical requirements to allow valid estimation procedures to determine parameters involved; (2) systematic method for analytical analysis and prediction of the yield from liquid propellant explosions by the use of seven charts; (3) fireball hypothesis, experimental verification, and description of reaction front and shock wave behavior in liquid propellant explosions; and (4) analysis of fireball and post-fireball combustion products cloud history and composition. Results of this investigation provide new information with regard to liquid propellant explosion characteristics and permit the prediction of explosion yields in ranges where experimentation is not practical, if not impossible. Author

N69-24264# Aeronautical Research Council (Gt. Brit.)
SOME NOTES ON FUEL BOILING LOSSES AND FUEL-TANK PRESSURISATION IN A LONG-RANGE SUPERSONIC AIRCRAFT
W. G. S. Lester 1968 25 p refs Supersedes RAE-TR-67137; ARC-29522; See N68-21289
(ARC-CP-1017; RAE-TR-67137; ARC-29522) Copyright. Avail: HMSO, London: 11s 6d

A method of calculating the fuel boiling losses, due to aerodynamic heating, from a supersonic aircraft with integral wing fuel tanks is devised and is applied to the Concord, assuming flight conditions of Mach 2.2 at 64,000 ft altitude using low boiling point kerosene fuel. The calculations are based on certain assumptions defined in the text concerning fuel distillation characteristics, heat transfer data and boiling fuel distribution in the tankage. Because much of the evaporated fuel may condense in the vent system and be recovered it is likely that the fuel loss through boiling in unpressurised tanks will be less than the weight of additional equipment required to pressurise the tanks. Since the fuel transfer pump duty is very arduous, the feasibility of operating without tank pressurisation depends on the actual pump performance achieved. Suggestions are made for reducing the severity of the conditions affecting fuel thermal stability by modified fuel handling procedures in the aircraft. Author (ESRO)

N69-24351# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Stuttgart (West Germany).
THEORETICAL PERFORMANCE OF THE HYBRID ROCKET PROPELLANT COMBINATION FLOX/POLYETHYLENE [THEORETISCHE LEITUNGEN DER LITHERGOLEN RAKETENTREIBSTOFFKOMBINATION FLOX/POLYAETHYLEN]
R. E. Lo Feb. 1969 29 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-69-02) Avail: CFSTI

Theoretical values of specific impulse were calculated for the system FLOX/Polyethylene. The optimum mixture ratios were determined for various FLOX concentrations between 0 and 100% fluorine. Maximum theoretical specific impulse occurs at stoichiometric combustion with 70% fluorine in the F_2/O_2 mixture. For systems using such oxidizer mixtures theoretical combustion temperatures and compositions of combustion gases are plotted as functions of mixture ratio. Author

N69-24400# White Sands Missile Range, N. Mex. Atmospheric Sciences Research Office.
DIFFUSION NOMOGRAMS AND TABLES FOR ROCKET PROPELLANTS AND COMBUSTION BY-PRODUCTS
Frank V. Hansen and Gary A. Ethridge Jan. 1968 49 p refs
(AD-680178; ECOM-5171) Avail: CFSTI CSCL 13/2

An empirical diffusion equation is numerically evaluated to provide average downwind travel distances and average concentrations in terms of measured temperature differentials near the earths surface. The resultant nomograms and tables for twelve rocket propellants and a combustion by-product may be used to estimate the hazard corridors associated with toxic vapors from these chemical compounds. Author (TAB)

N69-24526# Atlantic Research Corp., Alexandria, Va. Thermodynamics and Combustion Section.
AN OPTICAL BOMB STUDY OF THE COMBUSTION OF SOLID PROPELLANTS IN HIGH ACCELERATION FIELDS Semiannual Technical Report, 1 May–31 Oct. 1968
Merrill K. King and Edward T. McHale 20 Dec. 1968 13 p refs
(Contract N00014-67-C-0455)
(AD-680040) Avail: CFSTI CSCL 21/2

Under the subject program, an experimental study of the effects of acceleration fields on the burning rate of solid propellant grains is being conducted. The general plan is to investigate a variety of formulations over a range of pressures and acceleration loadings, the results to be used to evaluate theoretical models of the process or to form the basis for improved models. In this report the results for two formulations are presented. The acceleration vector in these tests, produced by spinning a disc-shaped grain, was directed normal to and away from the surface. For one of the propellants, which contained only CTPB binder and AP, the burning rate decreased approximately 20 percent at g-loadings of 500. At higher accelerations levels up to 1600 gs an additional 10 percent decrease appeared to occur, although the changes were too small to be determined with certainty. For a second propellant, similar to the first but containing 12 percent powdered aluminum, the change in burning rate if it existed at all was too small for any consistent trend to be detected at g-levels up to 2000. For both propellants the effects were independent of pressure up to 50 atm. Author (TAB)

N69-24613# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.
AN APPROXIMATION METHOD IN THEORY OF UNSTEADY RATE OF BURNING OF POWDER
A. G. Istratov, V. B. Librovich, and B. V. Nozovhilov Dec. 1968 16 p refs
(AD-680223; PA-TT-150) Avail: CFSTI CSCL 21/9.2

A change in pressure will change the combustion rate of powder. A quasi-steady condition appears when the change in pressure is slow, so that the temperature-profile in the heated layer of powder can follow the changes in pressure. When the pressure is changing rapidly, the temperature-profile in the powder is lagging behind the pressure and the combustion rate of the powder will differ from a quasi-steady rate. Analytical expressions are derived with the aid of an approximate method of integral relationships for unsteady combustion rate of a powder-model whose combustion rate is determined only by the pressure and the temperature gradient at the surface of the condensation phase. Cases of both instantaneous and exponential changes in pressure are examined. Conditions favoring the extinguishing of burning powder during a drop in pressure are determined. A comparison is given with the results of a numerical calculation. Cases of linear and exponential relationships between the steady combustion rate of powder and its initial temperature were investigated. Author (TAB)

N69-24683# TRW Systems, Redondo Beach, Calif.
QUASI-STEADY SPHERIOCOSYMMETRIC MONOPROPELLANT DECOMPOSITION IN INERT AND REACTIVE ENVIRONMENTS
Francis E. Fendell Durham, N. C. AROD Oct. 1968 16 p refs Submitted for publication
(Contract DAHC04-67-C-0015)
(AD-680306; AROD-6453.12) Avail: CFSTI CSCL 21/2

The quasi-steady adiabatic vaporization and subsequent exothermic decomposition of a pure monopropellant spherical droplet is examined in the absence of free and forced convection. The Lewis number is fixed at unity and linear variation of the universal diffusion coefficient with temperature is adopted. A direct one-step first-order decompositional burning is postulated. By means of inner-and-outer (matched asymptotic) expansions the vaporization rate is analytically determined for cases in which the ambient atmosphere is inert with respect to the product of decomposition. Both the case of very large and very small first Damkohler number is considered (where the first Damkohler number is the ratio of the rate of reaction to the rate of mass diffusion). Then a two-step irreversible reaction model is examined for the case in which the ambient atmosphere is reactive, in bipropellant fashion, with the product of decomposition. Conditions for sequential concentric flames are described. Author (TAB)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N69-23419*# Princeton Univ., N. J. Guggenheim Aerospace Propulsion Labs.
CURRENT PATTERN AND GAS FLOW STABILIZATION IN PULSED PLASMA ACCELERATORS
Alan C. Eckbreth (Ph.D. Thesis) Dec. 1968 218 p refs
(Grant NGL-31-001-005)
(NASA-CR-100696; Rept-857) Avail: CFSTI CSCL 21C

Spatial stabilization of the formerly propagating current patterns in the exhaust plume of a linear pinch discharge device fitted with an anode exhaust orifice, has led to the construction of a parallel-plate accelerator in which this phenomenon can be more conveniently studied. Stabilization of a propagating current sheet driven by a 120,000 ampere× 20 μsec rectangular current pulse is precipitated by partially insulating the electrodes. Stabilization of the current sheet at the electrode-to-insulator discontinuity is studied with Kerr cell discharge, wedge flow photography, magnetic and electric field probes, and terminal voltage measurements. These measurements indicate the stabilized discharge continues to accelerate gas through itself as long as gas from the prior prefilling of the discharge chamber remains. A shock tube gas injection technique is used to supply fresh gas to the stabilized current discharge. Author

N69-23422# Naval Air Propulsion Test Center, Philadelphia, Pa. Aeronautical Engine Dept.
EVALUATION OF EXPERIMENTAL SAFETY FUELS IN A CONVENTIONAL GAS TURBINE COMBUSTION SYSTEM Final Report
Andrew J. Atkinson Apr. 1969 31 p
(FAA Order FA67-NF-AP-20)
(NA-69-1; DS-68-27) Avail: CFSTI

Performance evaluation of a typical gas turbine engine combustion system was conducted to determine the combustion characteristics of two gelled Jet A fuels (Jet A plus 1.5% N-coco γ-hydroxybutyramide, and Jet A plus 2% of a styrene type polymer). Testing of an emulsified fuel was terminated due to separation of the emulsion by the shearing action of the boost pump in the system. The conclusions reached: (1) indicate the feasibility of employing gelled fuels from a combustion standpoint and, (2) demonstrate filtration, atomization, and deposition problems. Author

N69-23519*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
STEADY-STATE INTERACTIONS FROM MACH 1.98 TO 2.50 BETWEEN A TURBOJET ENGINE AND AN AXISYMMETRIC INLET WITH 60-PERCENT INTERNAL AREA CONTRACTION
Robert E. Coltrin and David A. Choby Washington Apr. 1969 28 p refs
(NASA-TM-X-1780) Avail: CFSTI CSCL 21E

An investigation of the steady-state interactions between a Mach 2.5 axisymmetric mixed-compression inlet and a turbojet engine was conducted. Engine installation did not grossly alter the magnitude or distribution of total pressure at the inlet diffuser exit from the values obtained with a choked plug installed. However, when a large circumferential total-pressure distortion was present at the compressor face, the engine altered the flow field by inducing a circumferential distortion in the static pressure without significantly affecting the total-pressure profile. Limited data at a constant speed showed that large radial distortions caused a slight loss in compressor pressure ratio. Author

N69-23823*# Aerojet-General Corp., Sacramento, Calif. Propulsion Div.
ADVANCED INJECTORS FOR SPACE STORABLE PROPELLANTS Quarterly Report, 1 Oct. 1968–1 Jan. 1969
15 Jan. 1969 32 p
(Contract NAS7-713)
(NASA-CR-100671; Rept-713-Q-2; MPL-6) Avail: CFSTI CSCL 21H

Technical effort during the second quarter of this contract was concentrated on fabrication experimentation and flow evaluation of sample injector stacks. Five sample stacks were fabricated and flowed for pattern check during the reporting period. Four of the five samples were leak tight while the fifth was not. All five stacks show various degrees of plugging in one circuit or the other. Fabrication parameter variations included braze plating thickness, braze temperature and method of plating. A summary of the fabrication techniques and results are shown. As a preliminary result a modified platelet design has been completed which increases the size of the channels in all metering areas to minimize the possibility of plugging with braze alloy. Author

N69-23881# National Physical Lab., Teddington (England). Ship Div.
PROSPECTS FOR UNCONVENTIONAL MARINE PROPULSION DEVICES
A. Silverleaf Jan. 1969 41 p refs Presented at the 7th Symp. on Naval Hydrodyn., Rome, Aug. 1968 Sponsored jointly by US ONR, Marina Mil. Ital., and INSEAN
(NPL-Ship-131) Avail: CFSTI

Some general points are examined, and an attempt made to define criteria which help the designer to choose the propulsion system. Although there are few rules which apply to all classes or types of ship, the simplest useful parameter is the speed/displacement ratio. The principal features of the main types of propulsion device are also outlined, and their potentialities and

limitations considered. The long established, orthodox open marine propeller is still a most efficient device for converting rotational energy into propulsive thrust, but its range of application is not unlimited. To extend the range of efficient operation, other types of screw propellers have been developed; these include ducted, controllable pitch, contra-rotating and fully cavitating propellers. Paddle wheels and vertical axis propellers, water jets and airscrews have also been used for marine purposes, while air-blown ramjets and magneto-hydrodynamic devices have also been proposed. Finally, some of the hydrodynamic, engineering and operational factors affecting particular ship types are considered in more detail.
Author (ESRO)

N69-23891 Centro Nazionale di Ricerca sulla Technologia della Propulsione e dei Materiali Relativi, Milan (Italy).
THE NATIONAL RESEARCH CENTER OF PROPULSION TECHNOLOGY AND MATERIALS AND ITS ACTIVITY DURING 1963-1967 [IL CENTRO NAZIONALE DI RICERCA SULLA TECNOLOGIA DELLA PROPULSIONE E DEI MATERIALI RELATIVI E LA SUA ATTIVITA NEL QUADRIENNIO 1963-1967]
15 Sep. 1967 225 p
Copyright. Avail: Tamburini Editore S.P.A., Milan

The structure of the CNPM (Centro Nazionale di Ricerca sulla Tecnologia della Propulsione et dei Materiali Relativi) is described and their test and research facilities are illustrated. The buildings are given and the collaboration between the Center and European industries is briefly outlined.
Author (ESRO)

N69-23976# Advisory Group for Aerospace Research and Development, Paris (France).
HELICOPTER PROPULSION SYSTEMS
Jun. 1968 490 p refs In FRENCH and ENGLISH Presented at the Propulsion and Energetics Panel of AGARD 31st Meeting, Ottawa, 10–14 Jun. 1968
(AGARD-CP-31) Avail: CFSTI

The propulsion topics covered include engine technology, engine components, rotor tip propulsion, mechanical transmission and control systems, advanced helicopter propulsion, and operational efficiency. For individual titles, see N69-23977 through N69-24001

N69-23977# Advisory Group for Aerospace Research and Development, Paris (France).
FUTURE REQUIREMENTS FOR MILITARY HELICOPTERS AND THEIR PROPULSION SYSTEMS
P. V. Brown *In its* Helicopter Propulsion Systems Jun. 1968 9 p (See N69-23976 12-28)
Avail: CFSTI

The importance of improved propulsion systems in the design of advanced helicopters for the post-1975 period is emphasized, as well as the need for cooperation between nations in developing air vehicles for tactical air mobility. To achieve optimal and configuration for the advanced aircraft, a complete integration between engine and airframe design is required. Several problem areas associated with current propulsion systems are introduced, and the difficulty in establishing a standard definition for helicopter type aircraft is mentioned. AGARD recently defined helicopters as all VTOL aircraft in which low speed lift is provided by unducted rotary wings, with a relatively low disk loading (below 10 lb/ft^2).
A.C.R.

N69-23978# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
HELICOPTER PROPULSION SYSTEM STATE OF THE ART AND ITS IMPLICATION TO ENGINE TECHNOLOGY
Herbert N. Shohet *In* AGARD Helicopter Propulsion Systems Jun. 1968 14 p (See N69-23976 12-28)
Copyright. Avail: CFSTI

An overview is presented on the effect of gas turbine engine application to helicopter propulsion systems, insofar as the state of the art of the aircraft systems involved is concerned. Mention is also made of areas in which results from advances in helicopter operations have affected engine technology. Interrelationships between the two topics for such factors as specific weight, specific fuel consumption, hot day power and helicopter oriented power ratings are highlighted. The constant output shaft speed requirements of the helicopter free turbine engines are explained, and control of the turbine engine fuel flow is discussed. The importance of proper engine mounting and its effect on shaft alignment, engine temperature growth and vibrational characteristics in the helicopter installation are emphasized. Various engine starting systems and the necessity, in some cases, of self-sufficiency in the field are presented. Progress in the design of air induction systems as helicopter airspeeds have increased is summarized. Anti-icing systems design and the analytical tools used are discussed, as well as engine foreign object damage problems and various approaches to their solution.
Author

N69-23979# Boeing Co., Philadelphia, Pa. Vertol Div.
HELICOPTER PROPULSION TRENDS
C. W. Ellis, J. Acurio, and J. J. Schneider *In* AGARD Helicopter Propulsion Systems Jun. 1968 27 p (See N69-23976 12-28)
Avail: CFSTI

The development of helicopter propulsion systems, from reciprocating engines to the recent adoption of gas turbine propulsion, is traced; and areas requiring further improvement are identified. Specific topics include drive systems; helicopter engine controls; and maintainability, reliability and cost of turbine systems. In addition, projected requirements and future power plant configurations are defined.
A.C.R.

N69-23980# Army Aviation Materiel Labs., Fort Eustis, Va. Propulsion Div.
ADVANCED ENGINE DESIGN POINT CONSIDERATIONS
Clarence H. Carper *In* AGARD Helicopter Propulsion Systems Jun. 1968 17 p refs (See N69-23976 12-28) Avail: CFSTI

The utilization of advanced component technology and the effects of engine design point selection on performance for nonregenerative free turbine turboshaft engines were considered. Two families of advanced engines were studied, one with the design point at 100% power and the other with the design point of 80% power; 100% power was considered as Military Rated Power. The technology level for the advanced engines was commensurate with initiation of production in the 1975-80 time frame, although comparisons were made with current high pressure ratio engines, whose level of technology is in the engineering development or initial production stages. A range of 500 to 10,000 horsepower was covered.
Author

N69-23981# Turbomeca S.A.—Brevets Szydlowski, Bordes (France).
TURBOPROPS FOR HELICOPTERS [LES GROUPES TURBOPROPULSEURS POUR HELICOPTERES]
H. C. Dabbadie *In* AGARD Helicopter Propulsion Systems Jun. 1968 10 p In FRENCH (See N69-23976 12-28)
Avail: CFSTI

The considerable improvement during the last twenty years in helicopter production comes not only from progress in the field of rotary wing aerodynamics, but also from that relating to the conception and production of turbine groups. With the utilization of mechanical transmissions, numerous projects, based on the new engine ideas, show that such an evolution must lead to more simple and relatively less expensive configurations, while offering greater safety and increased speed, efficiency, and passenger comfort. The use of turbine engines for rotary wing aircraft is discussed in terms of the number of motors used, the number of shafts, a promising formula for a turbine driven rotor configuration, prise considerations, and future developments closely related to presently used gas turbines.
Transl. by P.A.S.

N69-23982# Rolls-Royce, Ltd., Derby (England). Small Engine Div.
HELICOPTER GAS TURBINES: CONTROL OF QUALITY AND ESTABLISHMENT OF RELIABILITY
F. W. Morley *In* AGARD Helicopter Propulsion Systems Jun. 1968 9 p (See N69-23976 12-28)
Avail: CFSTI

Basic principles are enumerated by which the usefulness of an engine may be judged and standards of quality may be specified in order to ensure its service reliability to the user. Suggestions are also made for the organizational structure and required procedures to implement these principles. A.C.R.

N69-23983# General Motors Corp., Indianapolis, Ind. Allison Div.
ALLISON T63 REGENERATIVE ENGINE PROGRAM
Edward J. Privoznik *In* AGARD Helicopter Propulsion Systems Jun. 1968 14 p (See N69-23976 12-28)
Avail: CFSTI

A brief summary is presented of a program to determine (1) regenerative engine performance under actual operating conditions, and (2) regenerative engine-aircraft compatibility. Prior parametric studies indicated that regeneration could provide a significant improvement in army aircraft range capability and fuel logistics. The flight test portion of the program demonstrated the feasibility of a regenerative engine as a powerplant for aircraft operation. No serious problems were encountered. The engine demonstrated a horsepower-to-weight ratio of 1.62:1 and a maximum specific range of 1.25 miles per pound of fuel at 5000 feet with a 2200-pound aircraft gross weight. The addition of a regenerator increased the maximum specific range by 25.7%. Also, the regenerator demonstrated the capability of withstanding the temperature transients associated with engine operation. Author

N69-23984# Turbomeca S.A., Bretets Szydlowski, Bordes (France)
COMPONENTS OF HELICOPTER TURBINE ENGINES [LES COMPOSANTS DES TURBOMOTEURS D'HELICOPTERES]
H. C. Dabbadie *In* AGARD Helicopter Propulsion Systems Jun. 1968 8 p In FRENCH (See N69-23976 12-28)
Avail: CFSTI

The use of gas turbines for helicopter propulsion is discussed in terms of three successive stages of development. Improvements in specific power, fuel consumption, and weight are described. The technology of the turbine engines, results and future perspectives, and the improvement of the thermodynamic cycles due to better component characteristics and the use of new materials, are considered. Transl. by P.A.B.

N69-23985# United Aircraft of Canada, Ltd., Jacques Cartier (Quebec).
HIGH PRESSURE RATIO CENTRIFUGAL COMPRESSORS FOR SMALL GAS TURBINE ENGINES
R. E. Morris and D. P. Kenny *In* AGARD Helicopter Propulsion Systems Jun. 1968 28 p Sponsored in part by Can. Govt. Defence Res. Board (See N69-23976 12-28)
Avail: CFSTI

The performance of single stage centrifugal compressors with pressure ratios in the range 10:1 to 15:1 is discussed. A major problem with high pressure ratio compressors is the avoidance of separation within the impeller. Since the separation results in a nonuniform flow, which has a major effect on the diffuser and particularly on the vaneless space performance, every effort is made to reduce separation within the impeller. The research impellers described were designed initially by a relatively simple potential flow method, but the resulting loading diagrams were assessed by a pipe analogy method. A diffuser capable of accepting the nonuniform supersonic flow from the impeller with low loss and good operating range was developed in conjunction with these impellers. Test results are given on a number of experimental compressors with overall pressure ratios of 12:1 after diffusion to Mach 0.18. A discussion of future problems and prospects for these high pressure ratio compressors is also included. Author

N69-23986# Rolls-Royce, Ltd., Derby (England). Aero Div.
REACTION DRIVE SYSTEMS FOR HELICOPTERS
G. L. Wilde *In* AGARD Helicopter Propulsion Systems Jun. 1968 20 p refs (See N69-23976 12-28)
Avail: CFSTI

New possibilities and problems involved in the use of reaction drive systems, which eliminate the reduction gears and normal tail rotor but are usually less efficient in fuel consumption per ton lift, are explored as applied to the giant crane helicopter. Gas and air power systems investigated for use with reaction drives are briefly described, as well as the design and performance characteristics of rotor tip mounted turbojet engines. Published data for engine and rotor performance for helicopters with turbine mechanical drive systems are also analyzed. As a result of this preliminary study, it is concluded that the best reaction systems appear to have a fuel consumption per ton lift of between 1.5 to 2 times that of the most efficient turbine mechanical drive system, but that the weight saving due to elimination of reduction gears and tail rotor may offset this in the giant crane helicopter. A.C.R.

N69-23987# Hughes Tool Co., Culver City, Calif. Aircraft Div.
HOT CYCLE ROTOR PROPULSION
R. J. Sullivan *In* AGARD Helicopter Propulsion Systems Jun. 1968 22 p refs (See N69-23976 12-28)
Avail: CFSTI

The performance characteristics of the XV-9A research helicopter, which established the feasibility of hot cycle rotor propulsion, are reviewed. Preliminary calculations indicate that this rotor performance in combination with advanced technology engines of moderate bypass ratio (0.7 to 0.8) will produce hot cycle helicopters having better payload/empty weight ratios than concurrently available shaft-driven helicopters for all reasonable flight durations. A rotor/wing aircraft incorporating the hot cycle propulsion system will be capable of attaining high speeds (450 knots) and will have a higher payload/empty weight ratio than stowed-rotor type aircraft for all ranges of interest. Author

N69-23988# Sud-Aviation, La Courneuve (France).
PROPULSION OF HELICOPTER ROTORS AND COMBINED BY A COLD JET
Francis Maillard *In* AGARD Helicopter Propulsion Systems Jun. 1968 13 p In FRENCH (See N69-23976 12-28)
Avail: CFSTI

After an historic review of the application of reaction propulsion to helicopters, the choice of what pressure to adopt for such a propulsion method is examined. Whether it is a question of propulsion of the rotor or of the whole configuration, the pressure must be such that ejection speeds are in an acceptable relationship with the proper speeds of the exhaust nozzles. Bearing in mind the efficiency of the compressors used and the inevitable losses of charge and temperature, it is shown that cold jets allow a better adaptation than hot jets. In the case of rotor drive, the choice of which pressure to adopt is dictated by the peripheral speed of the exhaust nozzle. Two possible concepts are described, one of which is applicable to pure helicopters and the other to the propulsion of combined types, such as rotojets. Transl. by P.A.B.

N69-23989# Boeklow G.m.b.H., Ottobrunn bei Muenchen (West Germany).
LOW PRESSURE REACTION DRIVE SYSTEM FOR LARGE HELICOPTER ROTORS

G. Reichert and E. F. Weiland *In* AGARD Helicopter Propulsion Systems Jun. 1968 15 p refs (See N69-23976 12-28)
Avail: CFSTI

A reaction drive system using fuselage installed by-pass engines as gas generators and a gas duct system inside the rotorblade is described. Such a system promises advantages for large helicopters because of empty weight reduction compared to shaft-driven helicopters in the upper payload range. One basic problem in the layout concerns matching of the internal and external aerodynamics. The internal aerodynamics are mainly influenced by the gas generator and duct system, the external aerodynamics by the aerodynamic layout of the rotor. Possible gas generators are: pure jet engines (hot cycle); by-pass engines (mixed cycle); shaft driven compressors (cold cycle). Each type of the engines has a limited working regime, such as pressure ratio and temperature. A comparison is made of the different types of reaction systems in terms of efficiency, working regime and fuel consumption. Comments concerning design problems for rotor blades and rotorhut in the view of modern techniques are given. Author

N69-23990# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany)
EFFICIENCY IMPROVEMENT OF HELICOPTER TIP-DRIVE SYSTEM
G. Kannamueller *In* AGARD Helicopter Propulsion Systems Jun. 1968 32 p refs (See N69-23976 12-28)
Avail: CFSTI

The advantages inherent in tip-drive systems are simplicity, low system weight and applicability up to very high thrust values. Results of comprehensive research to further improve the system are shown, including gas energy losses due to ducting the gas through rotor head and rotating gas energy losses due to ducting the g rotor head and rotating blades, gas temperature distribution, and losses in the blade. Blade design requirements for low weights, maximum gas duct gross section, and temperature condition were derived and led to a design where the aluminum structure is separated functionally from the high temperature alloy gas duct by means of a thin insulation layer. Experimental works improved the feasibility of the blade design. A hot gas rotor system with a diameter of 10 m is presently undergoing functional tests to serve as a scaled down research device for heavy lift helicopters. Author

N69-23991# Sud-Aviation, Marignane (France).
INTEGRATION OF A TURBINE ENGINE GROUPING INTO THE GENERAL ARCHITECTURE OF A HELICOPTER WITH MECHANICAL TRANSMISSION
Rene Mouille *In* AGARD Helicopter Propulsion Systems Jun. 1968 19 p In FRENCH (See N69-23976 12-28)
Avail: CFSTI

Varied solutions, comprising a compromise between diverse considerations, are proposed by helicopter constructors for the integration of turbine engines into mechanical transmission apparatus. These choices include the number, power demands, and types of engines; optimal organization of the transmissions; minimum perturbations in air entries and escapes, minimal drag; vibration and noise repercussions, and maintenance facilities. Such considerations are investigated for the case of single rotor helicopters. Transl. by P.A.B.

N69-23992# Army Aviation Materiel Labs., Fort Eustis, Va.
MECHANICAL TRANSMISSION SYSTEMS FOR TURBINE POWERED HELICOPTERS
J. Nelson Daniel *In* AGARD Helicopter Propulsion Systems Jun. 1968 13 p refs (See N69-23976 12-28)
Avail: CFSTI

High speed shafting and high ratio speed reduction units are discussed for application to helicopters and other VTOL aircraft. Results of experimental programs are presented in which the effect on weight, efficiency, and reliability of such techniques of power transmission were determined. The following conclusions were reached: (1) Power transmission can best be accomplished at low torques and high speed shafting. (2) Shafting can be operated at high supercritical speeds with acceptable, predictable vibratory amplitudes. (3) When bevel gears are used, it is advantageous to operate at the lowest possible torque. (4) The roller gear transmission offers potential for light weight, efficient speed reduction; but multistage planetary systems may be preferred at some reduction ratios and power ratings. (5) Additional testing is required on the roller gear to acquire reliability and efficiency data. A.C.R.

N69-23993# Technische Hochschule Darmstadt (West Germany).
POWER AND SPEED CONTROL FOR PARALLEL OPERATION OF TWO SINGLE-SHAFT GAS TURBINES IN A HELICOPTER APPLICATION
Friedrich Watzelt, August Stepan, (Boelkow G.m.b.H.), and Christian Greune (Man-Turbomotoren G.m.b.H.) *In* AGARD Helicopter Propulsion Systems Jun. 1968 19 p refs (See N69-23976 12-28)
Avail: CFSTI

Problems associated with the design and operation of control systems for the parallel operation of two or more engines are discussed. A comparison is made of the single-shaft engine and the free-power turbine, where the accuracy of constant speed with varying pitch settings, as well as the time response of speed, decreases in case of failure of one engine. An explanation of the engine fuel control system and the overriding governor along the block diagram and a diagrammatic view of the controls and their transfer functions is also given. The interrelated control loops for the speed and load distribution parameters are discussed with respect to their time response characteristics. Problems of possible instabilities are related, pointing out the advantages of non-interacting, interrelated control loops. Finally, transient engine performance under various operating conditions is demonstrated by means of oscillograms recorded from a gas turbine propelled helicopter. Author

N69-23994# Westland Aircraft, Ltd., Yeovil (England).
COMPOUND HELICOPTERS
R. G. Austin *In* AGARD Helicopter Propulsion Systems Jun. 1968 124 p refs (See N69-23976 12-28)
Avail: CFSTI

The effectiveness of various degrees of lift and/or thrust compounding on a helicopter was studied. Though particular attention was paid to large transport-type aircraft, the results are considered to be generally applicable. With the given simplifying assumptions, it was concluded that, provided the vehicle is reasonably clean aerodynamically, the most productive aircraft will cruise at about 200 knots, use about 50% lift compounding, but no thrust compounding. If it is necessary to fly at, for example, 250 knots, virtually complete (80% or more) lift compounding is desirable, with over 200% thrust compounding; but a less productive aircraft is likely to result. Author

N69-23995# Lockheed-California Co., Burbank.
PROPULSION FOR COMPOSITE AIRCRAFT
J. B. Wheatley and D. T. Sasaki *In* AGARD Helicopter Propulsion Systems Jun. 1968 26 p (See N69-23976 12-28)
Avail: CFSTI

The stowed rotor concept is discussed as a means of attaining aircraft performance which combines the vertical lift and hovering performance of a helicopter with the high speed and cruise efficiency of an airplane. Particular emphasis is placed on obtaining this performance with respect to the propulsion system arrangement and its special features. Conversion from helicopter to airplane and from airplane to helicopter is discussed as to the effects of the conversion

mode on engine-rotor speed and power control; rotor control and stability; and flutter and divergence. Reasons are presented to justify the conclusion that the provision of devices for two independent modes of flight results in acceptable empty weight and payload fractions. Author

N69-23996# Bell Helicopter Co., Fort Worth, Tex.
THE EFFECT OF ADVANCED PROPULSION ON FUTURE ROTARY WING TYPE AIRCRAFT
L. M. Graham, A. W. Shultz, and H. C. Smyth *In* AGARD Helicopter Propulsion Systems Jun. 1968 16 p *ref* (See N69-23976 12-28)
Avail: CFSTI

Three types of rotary-wing aircraft were studied: a pure helicopter, a slowed-rotor compound helicopter, and a tilting-proprotor composite aircraft. Using the gas generator turbine-inlet temperature as an index, the general trends of improvement in specific fuel consumption, specific weight, specific fuel consumption at part power, and available power at high ambient temperatures were determined. These trends were then used to forecast the characteristics of rotary wing aircraft designed to hover at 4000-foot pressure altitude, at 95°F, with a payload and crew of 4000 pounds, and having design ranges of 200 and 400 nautical miles. It was concluded that for the same payload, performance, and mission, the aircraft using advanced technology engines will be much smaller and lighter than those using current generation engines. The fuel required and the installed power necessary to perform a given mission will be reduced with the advanced technology engines. These improvements will substantially increase the productivity and the cost effectiveness of the aircraft. The degree of improvement will vary almost directly with the design range. Author

N69-23997# Centro Nazionale di Ricerca sulla Tecnologia della Propulsione e dei Materiali Relativi, Milan (Italy).
NEW TRENDS FOR HIGH SPEED HELICOPTER PROPULSION
Corrado Casci and Emilio Bianchi *In* AGARD Helicopter Propulsion Systems Jun. 1968 16 p (See N69-23976 12-28)
Avail: CFSTI

Four pure helicopter configurations are analyzed, and the basic features of compound helicopters are listed as part of a study to determine the advantages derived from auxiliary propulsion and lifting systems. It was concluded that pure helicopters may be operated at high speed provided that they are equipped with particular rotor systems: i.e., rigid rotors coupled in different ways or a single rotor accompanied by a wing located at the retreating blade side of the rotor disc. However, pure helicopters intended for this purpose have several disadvantages, such as high mean and oscillatory loads on rotors and airframe, heavy transmission, and mechanical complications. For this reason, compound helicopter configurations appear to be the most suitable vehicles for use above a certain speed, since the use of a wing and propulsion system for sustaining the ship and overcoming drag is much simpler. For cruising speeds ranging between 200 and 250 KTS, the propeller appears to be the most adequate system. It was also emphasized that a medium size compound helicopter (gross weight not exceeding 12,000 lb) could be built economically in the near future. A.C.R.

N69-23998# Pisa Univ. (Italy).
SIMPLE SOLUTIONS OF THE HELICOPTER PROPULSION SYSTEM MADE POSSIBLE USING CLOSED CYCLE FOR THE WORKING FLUID
Dino Dini *In* AGARD Helicopter Propulsion Systems Jun. 1968 34 p refs (See N69-23976 12-28)
Avail: CFSTI

Several configurations for small helicopters operating in the 50 to 200 HP range of useful power are analyzed showing suitable rotor-engine integration using a light-weight closed cycle steam engine. It is demonstrated that a multiple expansion engine can turn directly without gearing the utilization shaft, thus reducing the total working fluid weight to an acceptable level. Real cycles, mechanical designs, with convenient economic, volume and weight characteristics, are discussed. The possible use of simple closed cycle engines, operating at different speeds and altitudes, with fluidic controls is also treated. Particular advantages are emphasized as a first step toward future applications at such time when compact heat sources, such as the Velox boiler, radioisotopes and nuclear reactors, become available for this purpose. A.C.R.

N69-24000# National Research Council of Canada, Ottawa (Ontario).
ICING AND THE HELICOPTER POWERPLANT
J. R. Stallabrass and R. D. Price *In* AGARD Helicopter Propulsion Systems Jun. 1968 14 p refs (See N69-23976 12-28)
Avail: CFSTI

The effects of icing on both reciprocating and turbine engines and the standard methods used to combat them are briefly discussed. Some of the specific icing problems associated with the various types of turbine engine installation in helicopters are treated, and a number of suggestions for their alleviation are given. A plea is made for a greater degree of cooperation and understanding between engine and airframe designers in the solution of these problems. Author

N69-24078*# Rocketdyne, Canoga Park, Calif.
THERMODYNAMIC IMPROVEMENTS IN LIQUID HYDROGEN TURBOPUMPS
Sep. 1968 299 p refs
(Contract NAS8-20324)
(NASA-CR-100753; R-7585; IR-2) Avail: CFSTI CSCL 21H

The continued effort in the evaluation of thermal conditioning problems in liquid hydrogen turbopumps to enhance mixed-phase operation and to minimize the system constraints on engine starts and restarts is described. Both analysis and evaluation of experimental data are presented on the chilldown of turbopump and rocket engine systems. The effects of two-phase hydrogen flow on turbopump performance and engine transient are also described. Author

N69-24169*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
FLOX/METHANE PUMP-FED ENGINE STUDY
J. W. Colbert, S. A. Mosier, and T. E. Bailey 10 May 1969 193 p refs
(Contract NAS3-7950)
(NASA-CR-72485; PWA-FR-3040) Avail: CFSTI CSCL 21H

An experimental program was conducted to demonstrate the feasibility of using the flox/methane propellant combination in a flight-type pump-fed rocket engine. Components from RL10A-1 oxygen/hydrogen engines were modified and the suitability of the modifications was verified in component tests; the program culminated with nine demonstration firings of the integrated engine system. The data acquired definitely established that a flight qualified flox/methane engine can be developed using existing technology. Author

N69-24223*# General Motors Corp., Indianapolis, Ind. Allison Div.
EXPERIMENTAL INVESTIGATION OF ADVANCED CONCEPTS TO INCREASE TURBINE BLADE LOADING. I: PERFORMANCE EVALUATION OF PLAIN ROTOR BLADE WITH FLOW TYPE VORTEX GENERATORS

H. G. Lueders Washington NASA Apr. 1969 45 p refs
(Contract NAS3-7902)
(NASA-CR-1342; EDR-4909-Vol-4) Avail: CFSTI CSCL 21E

The overall performance of a single stage turbine designed with a rotor blade suction surface diffusion factor of 0.3 and negative hub reaction was investigated over a range of equivalent speeds and expansion ratios. Plow type vortex generators were attached to the forward portion of the blade suction surface to prevent flow separation. Rotor exit surveys were taken of total pressure, flow angle, temperature, and hot wire data. A number of rotor blades had static pressure orifices located at the mean line section to record blade surface static pressures during rotation. The results of this investigation are compared with the performance of the same blade without the vortex generators attached. The overall performance characteristics of the turbine with vortex generators were very similar to the turbine without vortex generators. The total efficiencies at design equivalent speed and expansion ratio were 88.6 and 88.4 percent for the vortex generator and plain blade turbine, respectively. The turbine loss patterns, as determined from exit surveys, were very similar for the two tests. Author

N69-24284# Rolls-Royce, Ltd., Derby (England).
ENGINE CONTROL AND INSTRUMENTS PRESENTATION
D. Whitham *In* AGARD Probl. of the Cockpit Environ. Nov. 1968 5 p (See N69-24230 12-02)
Avail: CFSTI

Head-up display of primary flight information is discussed for the parameters of height, heading, airspeed, attitude, flight path angle, and the artificial horizon. Space for the extra displays necessary in a modern complex aircraft may also be found by time sharing display surfaces. An electronic display surface carried for another prime purpose, however, can be used for presentation of flight data profitably only if the flight information is not needed all the time. Problems associated with head-down displays, arising from the compactness of the symbols, human factors, or engineering difficulties, are summarized. P.A.B.

N69-24360*# Hughes Research Labs., Malibu, Calif.
ION ENGINE THRUST VECTOR STUDY Quarterly Report
S. Kami, W. G. Herron, and H. King Apr. 1969 52 p refs
Prepared for JPL
(Contracts NAS7-100; JPL-952129)
(NASA-CR-100772; QR-2) Avail: CFSTI CSCL 21C

The detail design and fabrication of the thrust stand and the 30 cm thruster is described. It includes results of tests performed on single components and also on component systems. Analysis of the effect of external environmental vibration on the thrust vector measurement accuracy is also included. A mechanically isolated vacuum chamber is shown in its preliminary planning stage. Thruster tests were performed and results described. Author

N69-24361*# Martin Co., Denver, Colo.
STERILIZABLE LIQUID PROPULSION SYSTEM Quarterly Report, 1 Jan.–31 Mar. 1969
Samuel C. Lukens Apr. 1969 38 p Prepared for JPL *Its* Issue 9
(Contracts NAS7-100; JPL-951709)
(NASA-CR-100774; MCR-67-15; QPR-9) Avail: CFSTI CSCL 21J

The program has included the design, assembly, and exposure of a fueled bipropellant liquid propulsion system to the ethylene oxide and heat sterilization environment. After exposure the system was successfully fired for 280 seconds. The program was supported by a materials compatibility test program and component verification program wherein suitability of all selected components was demonstrated prior to system assembly. Under an extension to the contract the system is being refurbished and will be subjected to additional heat sterilization prior to an additional test firing. Design changes were made to the oxidizer tank and the expulsion diaphragm. The fuel tank screen trap was also modified to eliminate two-phase flow from the tank when expelling in a negative 1-g regime. Author

N69-24372# Solar, San Diego, Calif.
MECHANISMS OF SAND AND DUST EROSION IN GAS TURBINE ENGINES Quarterly Technical Progress Report, 1 Jul.–30 Sep. 1968
C. E. Smeltzer and W. A. Compton Sep. 1968 119 p refs
(Contract DAAJ02-68-C-0056)
(AD-680299; RDR-1625-1; QTPR-1) Avail: CFSTI CSCL 21/5

The experimental program is organized to evaluate the relative importance of erosion influencing variables introduced by the carrier gas, the dust suspension and the target materials themselves. Test conditions have been chosen to simulate the range of gas temperatures (RT - 800 F) static pressures (1 - 18 atmospheres) and gas and particle velocities (500-1500 fps) encountered in a typical high-performance compressor. The report includes: (1) a literature survey and data review, (2) an analysis of the physical environment in a typical high-performance compressor and the formulation of an erosion test program based on this environment, and (3) the execution of the erosion test program, including the design and construction of special test equipment. Author (TAB)

N69-24495# Curtiss-Wright Corp., Wood-Ridge, N. J.
SMALL GAS TURBINE ENGINE COMPONENT TECHNOLOGY—TURBINE. VOLUME 1, PHASE 1: SUMMARY REPORT Final Report
T. Schober and W. Franklin Oct. 1968 328 p refs
(Contract DA-44-177-AMC-182(T))
(AD-680273; USAAVLABS-TR-68-50A) Avail: CFSTI CSCL 21/5

The report describes the aerodynamic, thermal, and mechanical design and analysis, fabrication, and experimental evaluation of a transpiration cooled, single stage axial-flow turbine component capable of operation at 2500F average inlet temperature. Combustor design and development and test rig design are described, as well as stator vane hot thermal and cold aerodynamic cascade testing. The objective of the program was to advance and demonstrate high turbine inlet technology for use in a gas generator with a compressor pressure ratio of 8 to 10 and an airflow of 4 pounds per second. Additional objectives included turbine work of 140 Btu per pound of airflow at a high level of turbine efficiency. Phase I report presents the design and analysis. It was concluded that the advanced technology incorporated in the turbine design relative to blade cooling and turbine mechanical integrity are practical and can be applied to the design of advanced small gas turbines. Author (TAB)

N69-24496# Curtiss-Wright Corp., Wood-Ridge, N. J.
SMALL GAS TURBINE ENGINE COMPONENT TECHNOLOGY—TURBINE. VOLUME 2, PHASE 2: SUMMARY REPORT Final Report
W. Franklin, J. Heilbron, and S. Moskowitz Aug. 1968 224 p refs
(Contract DA-44-177-AMC-182(T))
(AD-680235; USAAVLABS-TR-68-50B) Avail: CFSTI CSCL 21/5

The report describes the aerodynamic, thermal, and mechanical design and analysis, fabrication, and experimental evaluation of a transpiration cooled, single stage axial-flow turbine component capable of operation at 2500F average inlet temperature. Phase II report gives the details of manufacture and results of test evaluations. One hundred hours of complete stage testing were accomplished with 2 hours at 2500F. The cascade rig was tested for 87 hours which included 1.2 hours at 2650F. All testing was

in excellent condition after the tests and confirmed the efficacy of the thermal design and transpiration cooling as applied to small size blading. A work of 133 Btu per pound was achieved at a low level of efficiency, attributable to stator profile shape and low aspect ratio. One hundred thirty-seven hours of combustor testing at an average exit temperature of 2500F was accomplished with operating characteristics consistent with the turbine requirements. It was concluded that the advanced technology incorporated in the turbine design relative to blade cooling and turbine mechanical integrity are practical and can be applied to the design of advanced small gas turbine. Author (TAB)

N69-24540# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HERALD OF THE KIEV POLYTECHNIC INSTITUTE THERMAL ENERGY SERIES NO. 1, 1964 (SELECTED ARTICLES)
Yu. N. Savelev, G. S. Batyuk, V. N. Kryzhanovskii, V. A. Khristich, and A. M. Shevchenko Jun. 1968 22 p refs Transl. into ENGLISH from Vestn. Politekhnicheskii Inst., Ser. Teploenergetiki (USSR), no. 1, 1964 p 40–44; 50–57
(AD-680567; FTD-MT-24-92-68) Avail: CFSTI CSCL 21/5

Contents: Increasing the operational reliability of a jet igniter; The question of cooling efficiency of a perforated flame tube of a gas turbine combustion chamber. TAB

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N69-23478# State Univ. of Iowa, Iowa City.
APPLICATION OF INVARIANT IMBEDDING TO RADIATION TRANSPORT THEORY
John Lou Ridihalgh (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-14817

This thesis concerns the application of the invariant imbedding method to radiation transport theory. Numerical methods are developed to solve the reflection and transmission equations for slab geometry. A modified predictor-corrector method is used to integrate the equations. In addition approximations are made to the rigorous invariant imbedding equations for gamma transport. Calculations are made for the reflection of light in stellar atmospheres, the critical size of a bare multiplying slab, and the transport of gamma rays. For the gamma transport problem differential energy spectra and energy buildup factors for several media are also calculated. In all the calculations made there was no evidence of numerical instability in the modified predictor-corrector integration method. In the asymptotic portion of the calculations the step size of the integration was increased up to twelve times the initial step size with no decrease in accuracy. Dissert. Abstr.

N69-24727# European Space Operations Center, Darmstadt (West Germany).
EFFECT OF USING NEWER GEOMAGNETIC FIELD MODELS ON THE COMPUTATION OF THE MAGNETIC SHELL PARAMETER L
K. G. Lenhart Paris ESRO Jan. 1968 22 p refs
(ESRO-SM-70-ESOC) Avail: CFSTI

The computation of the geomagnetic shell parameter L is influenced by the chosen geomagnetic field model. The most widely used model was the Jensen and Cain field. Applying newer models which describe the real geomagnetic field more accurately results in considerable changes. These differences could cause difficulties in the comparison of different trapped radiation data. To overcome this, 'reference L values' are proposed. An economic method of computing these standard L values is described. (ESRO)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N69-23361 Arizona Univ., Tucson.
LOCAL WEAKENINGS OF FRAUNHOFER LINES ON THE SOLAR DISK
Gary Allen Chapman (Ph.D. Thesis) 1968 126 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-14908

Previous studies have shown that certain Fraunhofer lines are appreciably weakened in small regions having high magnetic field strength not associated with sunspots. The weakenings, which quite often appear as gaps in lines on spectrograms, form a delicate photospheric network on spectroheliograms, similar to, but finer than, the familiar chromospheric Ca II K_{232} network. The photospheric network seen in the λ6302.5 line of Fe I has a typical contrast of about 25–35% for regions in the vicinity of the disk center. This network is cospatial with the photospheric magnetic field seen on Leighton-type Z-photos, whereas the K network is not cospatial with the photospheric magnetic field but often extends beyond the boundaries defined by the photospheric field. Dissert. Abstr.

N69-23367*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE MICROMETEOROID EXPERIMENT ON THE OGO 2 SATELLITE
C. S. Nilsson and D. Wilson Feb. 1969 38 p refs
(Contract NAS5-11007)
(NASA-CR-100638; Rept-902-41) Avail: CFSTI CSCL 03C

The aim of this experiment was to measure the velocities, masses, and orbits of dust particles in the earth's dust cloud. The negative results obtained were instrumental in bringing about a reappraisal of the magnitude of this dust concentration. No orbits were determined, and it is questionable whether any micrometeoroids of mass $>10^{-12}$g impacted on the sensors during the 1300 hr in which good data were obtained. Two possible impacts were recorded, but these were more likely due to experiment noise. These two events give an upper limit to the flux of particles of mass $>10^{-12}$g of 3×10^{-10} particles/m^2 sec 2π ster. This figure is compared with data from other experiments. Author

N69-23400 California Univ., Los Angeles.
THE MAGNETOPAUSE SURFACES AND FIELDS FOR VARIOUS INCLINATIONS OF THE EARTH'S DIPOLE AXIS TO THE SOLAR WIND

Willard Paul Olson (Ph.D. Thesis) 1968 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-14549

The interaction of the solar wind with the earth's magnetic field is studied. A model for the determination of the shape of the magnetopause is developed which allows the inclusion of cases where the wind is directed obliquely toward the geomagnetic dipole axis. The variation in the shape of the surface with time is then examined. Particular attention is paid to the currents flowing on the magnetopause surface and the magnetic fields they produce in the vicinity of the earth. It is found that the magnetic field at the earth's surface produced by this model accounts for a considerable portion of the observed annual and semi-annual variations. The diurnal variations from these currents, although large, are unlike the observed S_q variations and must be masked by the magnetic fields produced by currents originating in the ionosphere. The magnetic field variations produced by this model at geosynchronous altitude are also studied. Dissert. Abstr.

N69-23429# Los Alamos Scientific Lab., N. Mex.
RADIATIVE TRANSFER EFFECTS IN CEPHEID ATMOSPHERES
C. G. Davis, Jr. and J. Bendt 23 Dec. 1968 7 p refs
(Contract W-7405-ENG-36)
(LA-4048) Avail: CFSTI

The diffusion approximations, used in nonlinear Cepheid pulsation calculations, were studied with a moments expansion method of the radiative transfer equation. The use of the diffusion approximation (gray case) does not introduce errors in the model (7 $M_\odot$ Baker–Kippenhahn) studied. A frequency dependent result, for this model, gives velocity and luminosity profiles in general agreement with the diffusion results. The continuum spectral characteristics are given. Author (NSA)

N69-23458 Colorado Univ., Boulder.
CHROMOSPHERIC HYDROGEN SPECTRUM AT THE 1962 SOLAR ECLIPSE
William Henze, Jr. (Ph.D. Thesis) 1968 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-14215

An expedition to New Guinea observed the chromospheric spectrum with two slitless spectrographs covering the wavelength range from 3200A to 9100A; the calibration utilized the solar disk as a standard source. The hydrogen data on the spectrograms are studied; a description is included of the overall reduction program which yielded intensities of all the lines at all heights observed. Comparison of the 1962 observations with data from the 1952 eclipse indicates that the previously suggested factor-of-two decrease in the earlier data should be modified to a wavelength dependent correction. The gradients agree reasonably well although there is a marked tendency for the 1962 data to drop below a simple exponential height distribution. The observed Balmer-to-Paschen line intensity ratios are reasonable, in contrast to the 1952 results, and have been used to infer self-absorption and optical depths in the Balmer lines. Dissert. Abstr.

N69-23493 Temple Univ., Philadelphia, Pa.
DETERMINATION OF STELLAR PARAMETERS FROM LUNAR OCCULTATION OBSERVATIONS
Thurman Rodney Kremser (Ph.D. Thesis) 1967 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-14141

The technique makes use of a photomultiplier tube and an electrometer amplifier whose output signal is recorded on magnetic tape recording signals in a frequency range from DC to 2500 hz. Simultaneous recording of standard time signals allows a precise determination of the time of the occultation. The apparent separation of binary stars in the direction of the motion of the advancing limb of the moon, and the relative intensities of the two components are calculated directly from the two superimposed diffraction patterns obtained during the occultation of the binary. Diffraction patterns are shown for occultations simulated in the laboratory using pinhole sources, and are compared with the actual diffraction patterns. Diffraction patterns are also shown which were computed for double extended sources of varying separation and relative intensities, and these are also compared with an actual occultation of a binary. Using these techniques, angular diameters were obtained and angular separations were measured, with an accuracy of ten to twenty percent. Dissert. Abstr.

N69-23505 Colorado Univ., Boulder.
PHOTOELECTRIC ECLIPSE OBSERVATIONS OF CONTINUUM AND CORONAL LINE EMISSION AT THE SOLAR LIMB
Spencer Richard Weart (Ph.D. Thesis) 1968 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-14406

A photoelectric spectrometer was used at the total solar eclipse of November 12, 1966 at Huachacalla, Bolivia. A small slit was placed radial to a solar image and parallel to the direction of motion of the lunar image. Light admitted by the slit was dispersed by a plane grating so that five photomultipliers and a PbS infrared detector received selected slices of the spectrum. A typical photomultiplier saw both a line and the nearby continuum, seperated by a chopping scheme. Outputs of the photomultipliers were automatically switched through five stages of sensitivity, making the response linear for light levels ranging over four orders of magnitude. At low light levels the limit of sensitivity was set by photon shot noise. Dissert. Abstr.

N69-23516 Arizona Univ., Tucson.
A POLARIMETRIC STUDY OF THE ATMOSPHERE OF VENUS
David Lee Coffeen (Ph.D. Thesis) 1968 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-14516

Between September, 1964, and August, 1967, observations were made of the linear polarization of sunlight scattered by the Venus atmosphere. Eight filters having intermediate-width bandpasses centered at wavelengths from 3400 Å to 8900 Å were employed. A two-channel Wollaston photoelectric polarimeter was used on 53 and 154 cm reflectors. Routine coverage of polarization as a function of phase angle was extended to small phase angles in a concentrated effort to obtain observations near superior conjunction. Near dichotomy, the distribution of polarization across the disk was observed as a function of wavelength. Dissert. Abstr.

N69-23830*# Martin Co., Denver, Colo.
C & SM LUNAR ORBITAL SCIENCE STUDY. VOLUME 1
Final Report
Oct. 1968 139 p refs
(Contract NAS9-8343)
(NASA-CR-98618; PR-34-113) Avail: CFSTI CSCL 03A

The contract has as its objective further definition of the scientific use of lunar orbital flights through analysis, review,

updating, and consolidation of experiment requirements, development status and feasibility, grouping, and mission requirements. The Phase B study represents a further step toward the preparation of detailed science mission plans, a process which is necessarily interative in nature. With the Lunar Science and Exploration Conference as a baseline, scientific objectives were grouped into four regimes: subsurface, surface, atmospheric, and cosmic. The subsurface regime was the least defined and required particular attention during the study. An analytical grouping rationale (roadmap) was developed which introduced a more fundamental technical experiment grouping approach than was used during the early phases of previous experiment programs. Author

N69-23531*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PIONEER 8 COSMIC DUST EXPERIMENT
Otto E. Berg Apr. 1969 12 p Submitted for publication
(NASA-TM-X-63521; X-616-69-153) Avail: CFSTI CSCL 03B

A cosmic dust sensor comprising a unique array of sensors, sensor controls, and in-flight calibrations was placed in a heliocentric orbit (0.99 to 1.088 a.u.) on board the Pioneer 8 satellite. The ionization and momentum imparted by the impact of a cosmic dust particle upon a surface are measured by the sensor to determine the particle's direction, speed, and mass. Prelaunch calibration studies using an electrostatic accelerator have shown that the sensors can measure kinetic energies of impacting particles as low as 0.6 erg and momenta as low as 2×10^{-5} dyne-sec. Author

N69-23537*# Volt Information Sciences, Inc., Washington, D. C.
INTERACTION OF COSMIC PROTONS WITH INTERPLANETARY PLASMA
Yu. M. Nikolayev Greenbelt, Md. NASA. Goddard Space Flight Center 16 Apr. 1969 6 p Transl. into ENGLISH from Vestn. Mosk. Univ., Fiz. i Astron. (Moscow), no. 1, 1969 p 113–116
(Contract NAS5-12487)
(NASA-CR-100689; ST-CR-IP-10827) Avail: CFSTI CSCL 03B

The interaction of cosmic protons with interplanetary plasma is based here on calculations considering only the excitation of longitudinal electrostatic oscillations, omitting the possible case of low frequency MHD-oscillations in interplanetary plasma, the accounting of the low-frequency branch of the spectrum, likely to alter the results falling outside the terms of reference of the present note. Author

N69-23543# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
GENERALIZATION OF THE HOHMANN TRANSFERS TO THE CASE OF PLANETARY ORBITS WITH SMALL ECCENTRICITIES AND INCLINATIONS [GENERALISATION DES TRANSFERTS DE HOHMANN AU CAS DES ORBITES PLANETAIRES FAIBLEMENT EXCENTRIQUES ET FAIBLEMENT INCLINEES]
Christian Marchal 1968 59 p refs In FRENCH; ENGLISH summary
(ONERA-P-124) Avail: CFSTI

The theoretical transfers of Hohmann in the solar system are calculated and collected in tabular form. The application to real transfers in the solar system gave solutions with an intermediate impulse for Earth–Mercury, and without an intermediate impulse for Earth–Venus and Earth–Mars, depending on the use of a final atmospheric braking for the four major planets. The modifications obtained with respect to the Hohmann transfers are very important and can be regarded only as a first approximation. The most important modifications are those due to the inclinations and the most favorable cases are those of nodal transfers for which the major axis of the transfer orbit coincides with the line of nodes of the two related planetary orbits. Author

N69-23588*# Rensselaer Polytechnic Inst., Troy, N. Y.
ON-LINE PARAMETER UPDATING OF THE MARTIAN ATMOSPHERE WITH MINIMUM STORAGE
Ronald E. Janosko Jan. 1968 43 p refs
(Grant NGL-33-018-091)
(NASA-CR-100684; RPI-MP-2) Avail: CFSTI CSCL 03B

To relate the density of the Martian atmosphere to the height above the surface for a descending capsule, the use of an adaptive model-reference scheme was investigated. It was assumed that the atmosphere is able to be structurally represented by the NASA adiabatic model which is good below the tropopause. Allowances were made for the variation of parameters in this model to cover the whole atmosphere. After this density equation was transformed to a suitable form, the parameters were identified and the independent variable changed so as to track in the direction of travel. Difference equations were formed based on the error equation applied at three different points. These difference equations were then solved for the change in model parameters so that they continuously follow the actual atmospheric parameters encountered in the Martian atmosphere. Author

N69-23601# Sandia Corp., Albuquerque, N. Mex. Aerospace Nuclear Safety Dept.
A PREDICTION OF THE HAZARDS FROM THE RANDOM IMPACT OF METEORITES ON THE EARTH'S SURFACE
V. E. Blake Dec. 1968 17 p refs Sponsored by AEC
(SC-RR-68-838) Avail: CFSTI

The probability of a person being injured or killed by a meteorite is estimated. It is concluded that there is a distinct possibility that someone will be seriously injured, possibly killed, by a meteorite fall within the next 50 years. In addition, there is a not insignificant probability that a large meteorite will impact a populated area and kill a number of people. Author (NSA)

N69-23630*# American Nucleonics Corp., Glendale, Calif.
TRANSIENT ELECTROMAGNETIC INTERACTION OF THE MOON WITH THE SOLAR WIND
Kenneth Schwartz and Gerald Schubert (Calif. Univ.) 1968 12 p refs
(Contract NAS2-5153)
(NASA-CR-73314) Avail: CFSTI CSCL 03B

The response of a homogeneous conducting moon to variations and irregularities in the interplanetary magnetic field is determined. The significant lunar response is forced by fluctuations in the motional electric field. In the limit of a highly conducting plasma surrounding the moon and for length scales of the interplanetary magnetic field irregularities much larger than the moon's radius, the magnetic field fluctuations in the lunar interior are the sum of variations in the driving interplanetary magnetic field plus field fluctuations driven by the motional electric field. The magnitude of the motionally induced time-varying magnetic field inside the moon is proportional to the product of the magnitude of the interplanetary magnetic field fluctuations and the lunar magnetic Reynolds number. This induced field is toroidal about an axis in the direction of the forcing motional electric field. The motionally induced magnetic field in the plasma is also toroidal and is confined to a thin layer near the lunar surface. The electric field is everywhere equal to the forcing motional electric field. Author

N69-23091 Sandia Corp., Albuquerque, N. Mex. Aerospace Nuclear Safety Dept.
COMPUTER CODE HRS004-7: A QUIKTRAN COMPUTER CODE FOR THE COMPUTATION OF INITIAL REENTRY ANGLE AND VELOCITY OF OBJECTS DECAYING FROM EARTH ORBIT
H. R. Spahr Dec. 1968 46 p Sponsored by AEC
(SC-RR-68-G22) Avail: CFSTI

QUIKTRAN computer code HRS004-7 calculates the initial reentry angle and velocity of objects decaying from earth orbit. The theory underlying this code is summarized, and the computer program and the input data required are detailed. Use of this code on the QUIKTRAN facility is discussed, and the output from this code is presented for two sample solutions. Author (NSA)

N69-23708*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER SIMULATION OF A CYLINDRICAL GALAXY
Frank Hohl Washington May 1969 51 p refs
(NASA-TN-D-5200) Avail: CFSTI CSCL 03B

A two-dimensional computer model is used to investigate the evolution of a self-gravitating cylindrical galaxy. The evolution of systems containing up to 100,000 mass rods is investigated by following the self-consistent motion of the mass rods. As the system evolves in time, it displays the various shapes observed in actual galaxies; however, any spiral structure which appears during the initial stages of the evolution disappears after about 10 rotations, and the final state of the system is that of a rotating bar or a circular cluster with a high central condensation. It is found that violent relaxation of phase mixing causes any unstable system quickly to build up large random velocities. The rate of buildup of random motions in stable systems was found to be described by a Chandrasekhar-type relaxation time. Author

N69-23715*# American Nucleonics Corp., Glendale, Calif.
UNIPOLAR INDUCTION IN THE MOON AND A LUNAR LIMB SHOCK MECHANISM
K. Schwartz, C. P. Sonett (Imperial Coll., London), and D. S. Colburn (NASA. Ames Research Center) [1968] 68 p refs
(Contract NAS2-5153)
(NASA-CR-73315) Avail: CFSTI CSCL 03B

The unipolar induction mechanism is employed to calculate electric field profiles in the interior of a chemically homogeneous moon possessing a steep radial thermal gradient characteristic of long-term radioactive heating. From the magnetic field, the magnetic back pressure upon the solar wind is found. The electric field profile is shown to depend only upon the activation energy of the geological material and the radial gradient of the reciprocal temperature. Since the moon is experimentally known to correspond to the case of weak interaction with the solar wind, the magnetic back pressure is calculated. In addition to the magnetic back pressure, the integration of the current continuity equation permits current densities and joule heating rates to be calculated. Author

N69-23724 Colorado Univ., Boulder.
THE TEMPERATURE STRUCTURE AND ENERGY BALANCE IN THE SOLAR CHROMOSPHERE
Stuart Davis Jordan (Ph.D. Thesis) 1968 231 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.00 Order No. 68-14221

A new approximate method is developed for calculating the temperature distribution in an atmosphere in which local mechanical energy dissipation is balanced by local net radiative loss in one or more spectral lines in which the atmosphere is optically thick. The method uncouples the equations of radiative transfer for the individual spectral lines from the energy conservation equation and from each other. This permits a solution of each individual transfer equation for the radiation field in each line. These results, combined with the energy conservation equation, yield the temperature distribution in the atmosphere, provided that the optical depth ratio of the spectral lines is known at each point. The temperature distribution in the solar chromosphere is calculated up through the region losing energy in the Ly_{α} line of hydrogen, using the above method. The radiating atoms treated are approximated by two bound levels or two bound levels plus a continuum, and the source of mechanical energy is assumed to be shock dissipation of acoustic waves. Dissert. Abstr.

N69-23729 Arizona Univ., Tucson.
INFRARED COLORIMETRY OF THE MOON
Dale Paul Cruikshank (Ph.D. Thesis) 1968 154 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-14519

For the purpose of studying the effects of the solar wind flux on the infrared reflectivity properties of rocks and minerals on the moon, a laboratory apparatus was constructed for irradiation of rock samples with a proton flux having the same energy as the ambient solar wind, but with 10^7 to 10^8 times the flux density. The design and development of the equipment are described. Several volcanic rocks were irradiated with this apparatus and the infrared colorimetric profiles in the wavelength range 0.8μ to 2.2μ were measured for the natural and irradiated samples. Irradiated rocks became redder, and absorption bands attributed to Fe^{3+} were transformed into Fe^{2+} bands. The relationship of the visual darkening of the rocks on irradiation and the changes in iron absorption bands are discussed relative to the lunar surface. Dissert. Abstr.

N69-23730 California Univ., Berkeley.
THE PROPAGATION OF SOLAR PROTONS
Stephen Wilson Kahler (Ph.D. Thesis) 1968 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-13919

Data from a scintillation counter experiment on the OGO-C spacecraft were used to analyze twelve energetic ($3<E<32$ MeV) solar proton events. The spacecraft, the performance of the experiment and methods of data analysis are discussed. The proton events presented were divided into four groups, each with well defined properties. The diffusive event follows an impulsive injection of particles at the sun and decays exponentially in time. The onset phase may be smooth or irregular, but the spectrum grows progressively softer during the decay phase. The storm particle event is a low energy event associated with a geomagnetic storm. During this event the spectrum first grows softer, then becomes harder. The halo structure is a stream of particles confined to the interplanetary lines of force which connect to the flare region at the sun. Recurrent proton events are due to the gradual release of particles from an active region in which a flare has occurred during a previous solar rotation. The two examples reported here showed narrow (≤ 10 hours) interplanetary spatial confinement. Representative fluxes and modified spectral behavior are presented for these events as a basis for describing a model of a typical solar proton event. Dissert. Abstr.

N69-23742# Bonn Univ. (West Germany). Astronomische Institute.
THE SPECTRAL INTENSITY DISTRIBUTION OF αLYR AS A STANDARD FOR SPECTROPHOTOMETRY [DIE SPEKTRALE INTENSITAETSVERTEILUNG VON α LYRAE ALS STANDARD FUER DIE SPEKTRALPHOTOMETRIE

Erich Lamla 1968 25 p refs In ENGLISH and GERMAN *Its* No. 77
Avail: CFSTI

From a discussion of the results of all absolute calibrations present today, it is possible to determine a mean distribution of the spectral intensities of α Lyr for the wavelength range $3000 \leq \lambda \leq$ Å. This gives the stellar continuum disturbed by all faint lines and should be used as a standard in spectrophotometric work. The mean intensity distribution shows for $\lambda < 4000$Å considerable differences from all the data used today. The calculated color indices are practically in accordance with the observed ones. It will be proved which of the models of theoretical stellar atmospheres can yield the same intensity distribution as that observed. By comparing the theoretical intensity distributions with the observed ones, an effective temperature can be determined for α Lyr of $(9700 \pm 200)^{\circ}$K. Attention will be pointed to the necessity of new observing data from the earth and also from satellites, especially for the ultraviolet spectral region on the short wavelength side of the Balmer jump. Author

N69-23756# RAND Corp., Santa Monica, Calif.
THE PROPOSAL FOR A JOINT LUNAR EXPEDITION: BACKGROUND AND PROSPECTS
Alton Frye Jan. 1964 22 p refs
(P-2808) Avail: Issuing Activity

President Kennedy's proposal to the United Nations on September 20, 1963, that the United States and the Soviet Union might join forces in an effort to land a man on the moon, is discussed in terms of factors bearing on the suggestion. The background for the speech is reviewed, including political and technical trends which raised the possibility of a national failure to meet the manned lunar landing schedule, new evidence of Soviet interest in more extensive cooperation in space, hints that the Soviet Union might be becoming more amenable to space arms control arrangements, and the Administration's interest in new efforts for a peaceful cold war solution. The technical and political prospects for Soviet–American collaboration are then discussed. It is pointed out that it is difficult to appraise the technical opportunities because of U.S. ignorance of the Soviet space program. Some categories for cooperation are identified. It is concluded that the proposal is primarily a political concept. Although adequate safeguards should be constructed against hostile exploitation of the space environment, the primary goal in space must be to serve national and international security; to the extent that cooperation facilitates formal arms control agreements concerning the deployment of offensive weapons in space, the proposal should be considered. P.A.B.

N69-23767 California Univ., Berkeley.
STUDIES IN I–Xe AND Pu–Xe DATING OF PILE-IRRADIATED ACHONDRITES
Charles Morris Hohenberg, Jr. (Ph.D. Thesis) 1968 53 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-13912

Neutron irradiated achondrites are analyzed by mass spectrometry of the rare gases released in stepwise heating experiments. In some cases the extracted xenon contains excess Xe^{129} from the decay of now extinct I^{129}. Results show that the Shallowater achondrite began to retain xenon simultaneously (within 1 or 2 million years) with ten chondrites previously studied. Assuming a continuous nucleosynthesis model, the onset of xenon retention in these bodies appears to have occurred 60 million years after the isolation of solar system material from galactic nucleosynthesis. The Lafayette achondrite, a meteorite which contains a small excess of Xe^{129}, appears to have lost a substantial part of that isotope attributable to I^{129} decay. Therefore, any I–Xe formation interval found for this meteorite is probably in error. Excesses of the heavy isotopes of xenon in Pasamonte were attributed to the decay of now extinct Pu^{244}. Dissert. Abstr.

N69-23782*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GRAPHIC METHOD FOR DETERMINING THE ABSOLUTE ATTITUDE OF SOUNDING ROCKET VEHICLES
Charles F. Miller, Jr. Washington May 1969 20 p refs
(NASA-TN-D-5172) Avail: CFSTI CSCL 22C

Measurements show that a rocket axis may trace out a complex attitude sequence. Using measurable parameters, a method is outlined which plots these three dimensional phenomena in two dimensions. The sun and its position, and the magnetic flux vector and its position, are used in combination with the solar and magnetic aspect angles at the rocket to determine attitude. When the time sequence of rocket attitudes is plotted, the momentum vector can be accurately determined. With any known rocket position, any other portion of the sky can, by coordinate transformation, be mapped from that orientation. The method was corroborated by a FORTRAN program. Author

N69-23785*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY FROM KINEMATICS: THE PROBLEMS OF INTERCEPT AND PURSUIT
James B. Eades, Jr. and George H. Wyatt Mar. 1968 196 p refs Submitted for publication
(NASA-TM-X-63527; X-643-69-106) Avail: CFSTI CSCL 22C

This investigation is primarily concerned with the plane problems of intercept and pursuit as seen from both the mathematical and physical points of view. Specific applications are not the major intent here, yet the ideas of reality are a strong undercurrent, retained in these developments. Several specific problem studies are undertaken, for illustrative purposes; and, simple graphical results are included in order to present a clearer picture of the happenings which occur during each of the maneuvers. In addition to describing the typical and specific trajectories, information is included which pertains to the time of flight, range and range-rate histories, as well as the acceleration levels to be experienced by the maneuvering vehicles. Categorically, the cases studied here include the simple linear intercept problem, the pursuit of a vehicle moving along a straight line path and a case wherein the target flies a circular trajectory. Author

N69-23856# Joint Publications Research Service, Washington, D. C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, no. 201 1 Apr. 1969 p 1–15 (See N69-23855 12-34)
Avail: CFSTI

News items are presented on the following subjects: a review of modern ideas on the atmosphere of Venus, some problems in astronomic refraction, current tasks in astronometry, a horizontal lunar telescope without coelostat, a large transit instrument for absolute determinations of right ascensions of southern sky stars, and the discovery of an unfamiliar dust material in the outer solar corona. Abstracts of scientific articles include: the origin of large lunar craters and circular seas, albedo of a planetary atmosphere, geometrical dimensions of sunspots and flocculi, a saturation function in the presence of a magnetic field, the nature of Tektites, disperse bituminous material in Tektites, spectral brightness of the

sky, determination of the transmission coefficient of the earth's atmosphere, the possibility of obtaining good star images with short exposures, the phenomenon of tremor in the telescopic images of stars, deformation on the front of waves causing star scintillation, and atmospheric transparency and stability. P.A.B.

N69-23888# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

INTERACTION BETWEEN A SATELLITE AND THE IONOSPHERE APPLICATIONS TO DRAG AND PROBE-MEASUREMENT PROBLEMS [INTERACTIONS D'UN SATELLITE AVEC L'IONOSPHERE ET APPLICATIONS AUX PROBLEMES DE TRAINEES ET DE MEASURES PAR SONDES]

Gerard Fournier 1969 32 p refs In FRENCH; ENGLISH summary

(ONERA-NT-142) Avail: CFSTI

The documents dealing with the perturbations of a collisionless plasma due to a hypersonic conducting body are analyzed. The fundamental assumptions are discussed, and the main results presented. Several directions of research to be explored are discussed, including determinations of the electronic and ionic densities, equipotentials in a wake with and without magnetic induction, and the stability of the flow and wave generation. Author

N69-23963*# Brown (D.) Associates, Inc., Melbourne, Fla.

VARIATIONS IN THE MATHEMATICAL MODELING FOR GEOS-A

J. G. Hartwell *In* Commun. and Systems, Inc. Proc. of the GEOS Program Rev. Meeting, Vol. 3 Feb. 1968 p 21–52 (See N69-23961 12-07)

(Contract NAS5-9938)

Avail: CFSTI CSCL 22C

An investigation was made to determine the effects on the orbit of GEOS-A when certain minor variations were introduced in the differential equations describing the motion of the satellite. In particular, for various short and intermediate arc experiments involving the GEOS-A satellite, the effects of variation in geopotential coefficients, uncertainties in the coordinates of earth's center of mass, and luni-solar perturbations were analyzed. Author

N69-23966*# Wolf Research and Development Corp., Bladensburg, Md. Applied Science Dept.

GRAVITY MODEL COMPARISON USING GEOS-1 LONG ARC ORBITAL SOLUTIONS

Francis J. Lerch (NASA. Goddard Space Flight Center), James G. Marsh (NASA. Goddard Space Flight Center), and Brian O'Neill *In* Commun. and Systems, Inc. Proc. of the GEOS Program Rev. Meeting, Vol. 3 Feb. 1968 p 65–145 (See N69-23961 12-07)

(Contract NAS5-9756)

Avail: CFSTI CSCL 22C

This report presents some of the results obtained from satellite tracking data using three different sets of coefficients in the mathematical model that describes the earth's gravitational field. The results were not intended to be used as a definitive evaluation of the different coefficients but as an assessment of the effects of different published coefficients, station coordinates, and earth parameters on orbital geodetic results. The orbital solutions were primarily estimated from GEOS-1 satellite data taken by five major geodetic optical tracking networks. The networks and camera types consisted of the SAO Baker–Nunn, GSFC STADAN and SPEOPT MOTS 40" and 24", USAF PC-1000, and the US C&GS BC-4. The three sets of gravity coefficients used were the SAO M-1 set, APL 3.5 set, and the NWL 5E-6 set. The semi-major axis, gravitational constant, and flattening consistent with each set of coefficients were also used. The station coordinates used were referenced to the SAO C-5 standard earth as no other complete set of optical station coordinates was available. Author

N69-23967*# Wolf Research and Development Corp., Bladensburg, Md. Applied Sciences Dept.

THE DETERMINATION AND COMPARISON OF THE GRARR AND MADGAR SITE LOCATION

Francis J. Lerch (NASA. Goddard Space Flight Center), Clarence E. Doll (NASA. Goddard Space Flight Center), Samuel J. Moss, and Brian O'Neill *In* Commun. and Systems, Inc. Proc. of the GEOS Program Rev. Meeting, Vol. 3 Feb. 1968 p 147–188 (See N69-23961 12-07)

(Contract NAS5-9756)

(X-552-67-540) Avail: CFSTI CSCL 22C

Improved coordinates for the MADGAR range and range rate site in Tananarive, Madagascar, have been estimated from GEOS-1 data sets using the NONAME orbit determination program. These coordinates have been compared with a preliminary estimate obtained from 39 passes of SRN-9 Doppler data from three satellites. Two independent estimates were obtained using the NONAME orbit determination program; one estimate was from optical flash sequence data taken at TANAN (MOTS 40" camera) during July 1968; the other from range measurements taken at MADGAR during November 1965. These two estimates of the site location are within five meters of each other. The comparison of previous location estimates with the optically determined NONAME estimate is shown by plots of the residual differences of the range and range rate measurements from five reference orbits. These orbits were determined solely from optical flash sequence data, and they had a maximum root mean square of fit of less than two seconds of arc. The residual difference for both range and range rate measurements clearly indicate that a significantly better set of MADGAR coordinates was obtained from the NONAME orbit determination program. Author

N69-24049*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

THE CORRELATION OF SOLAR MICROWAVE AND SOFT X-RAY RADIATION. PART I: THE SOLAR CYCLE AND SLOWLY VARYING COMPONENTS Progress Report

Charles D. Wende (Ph.D. Thesis) Mar. 1969 43 p refs

(Contract NAS5-9076; Grant NGL-16-001-002; Contracts JPL-951563; Nonr-1509(06))

(NASA-CR-100719; Rept-69-17-Pt-1) Avail: CFSTI CSCL 03B

An analysis of the solar cycle variation and the quiet sun component is presented. The integral solar X-ray flux between 2-12 A was measured by the spacecrafts Injun 1, Injun 3, Explorer 33, and Explorer 35. The integral flux between 2-9 A was observed by the Mariner V spacecraft. The data from Injuns 1 and 3 and Explorers 33 and 35, averaged in monthly intervals, show a long term variation in activity of at least a factor of five between 1961 and 1969. A slowly varying component which tracks the 10 cm radio flux is observed in the X-ray flux. This X-ray flux variation, about a factor of ten, is correlated with the appearance of major active regions on the solar disc. This slowly varying component is shown to correlate well with radio fluxes at frequencies greater than about 1 GHz and less well with radio fluxes at lower frequencies. The X-ray spectrum, obtained by comparing the 2-9 A flux with the 2-12 A flux, hardens during periods of high solar activity. Author

N69-24060*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
THE CORRELATION OF SOLAR MICROWAVE AND SOFT X-RAY RADIATION. PART 2: THE BURST COMPONENT
Progress Report
Charles D. Wende (Ph.D. Thesis) Mar. 1969 57 p refs
(Contract NAS5-9076; Grant NGL-16-001-002; Contracts JPL-951563; Nonr-1509(06))
(NASA-CR-100730; Rept-69-18-Pt-2) Avail: CFSTI CSCL 03B

A study is presented of the histories of solar flares observed at 2 cm and observed at X-ray wavelengths with Mariner V (2-9 A) and Explorers 33 and 35 (2-12 A) that shows post-burst increase and gradual rise and fall events are concurrent microwave and soft X-ray phenomena. The correlation between the X-ray flux and the radio flux is high but non-linear. The character of the correlation is consistent with a thermal flare theory in which the volume emissivity at X-ray wavelengths is of the spectral form $(dE/d\nu) \approx \exp(-h\nu/kT)$ and the radio flux is from the same region which is optically thick with a temperature T. The correlation yields the peak flare temperature, T_p, and the flare solid angle in terms of the fractional increase in temperature relative to the peak temperature. Author

N69-24170*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SEARCH FOR GAMMA-RAYS FROM THE CRAB NEBULA USING A DIGITIZED SPARK CHAMBER
Donald Avery Kniffen Washington May 1969 73 p refs
(NASA-TR-R-308) Avail: CFSTI CSCL 03B

Gamma ray astronomy provides an opportunity to obtain information directly related to the physical processes taking place within celestial objects; processes that may also give rise to the energetic charged particle cosmic rays. The detection of celestial gamma ray point sources may shed some light on the origin of cosmic rays. One of the most likely sources, the Crab nebula, was chosen for investigation in this experiment. The detector developed for this investigation is a digitized spark chamber, mounted in an oriented gondola and flown by balloon above all but a small amount of the earth's atmosphere. The detector is triggered by a scintillation counter Cerenkov detector charged particle telescope, in the event that no charged particle has passed through the anticoincidence scintillator that surrounds the entire detector. Analysis of the data consists of examining each event recorded during the flight for the pair-production events. The celestial arrival direction of each gamma ray is estimated by the bisector of the pair. The construction of the chamber with many thin plates alternated with the spark modules allows a determination of the gamma ray energy in the 30- to 250-Mev energy range by the multiple scattering technique. Author

N69-24206*# Scientific Translation Service, La Canada, Calif.
ATLAS OF THE REVERSE SIDE OF THE MOON. PART 2
Yu. N. Lipskiy et al Washington NASA Apr. 1969 92 p refs Transl. into ENGLISH of the Publ. "Atlas Obratnoy Storony Luny. Chast' 2" Moscow, Nauka Press, 1967
(Contract NASw-1496)
(NASA-TT-F-514) Avail: CFSTI CSCL 03A

An atlas has been compiled of photographs and data derived from Zond-3 observations of the reverse side of the moon. Discussed in the report are: (1) a description of the satellite and its flight to the moon; (2) details of the on-board phototelevision system; (3) extension of a single system of selenographic coordinates to the eastern section of the reverse side of the moon; (4) analysis of photographs, compilation of a map, and catalog of formations discovered; (5) object identification in overlapping region of photographs obtained by Luna-3 and Zond-3; (6) distribution density, size, and shape of craters; (7) topographic features of selected objects; (8) photometric characteristics of selected objects; and (9) a brief global survey of the lunar surface. Also included are lists of names proposed for formations discovered on the reverse side of the moon. A.L.

N69-24259*# Volt Information Sciences, Inc., Washington, D. C.
MICROMETEORIC INVESTIGATIONS IN THE NEAR EARTH SPACE ACCORDING TO OBSERVATIONS ON AES "KOSMOS-163" [MIKROMETEORY V OKOLOZEMNOM KOSMICHESKOM PROSTRANSTVE PO NABLYUDENIYAM NA SPUTNIKE "KOSMOS-163"]
B. P. Konstantinov et al 5 May 1969 12 p refs Transl. into ENGLISH from a Russian preprint
(Contract NAS5-12487)
(NASA-CR-100751; ST-IM-10830) Avail: CFSTI CSCL 03B

Measurements of micrometeor streams were conducted in 1967 aboard AES Cosmos 163 with the aid of interference-proof acoustic detectors. The magnitude of the flux of particles with mass exceeding $7 \times 10-10$g, constitutes 3.5×10^{-6}particle/m^2sec. These data fully corroborate the results of measurements on AES Cosmos 135, from which data on the existence of a dust cloud around the earth was rejected. The lengthy measurements, conducted during the action of the main yearly meteor streams, failed to reveal any manifestations of these fluxes' activity in the indicated region of masses of particles. Author

N69-24263# Royal Aircraft Establishment, Farnborough (England).
AIR DENSITY AT HEIGHTS BETWEEN 130 AND 180 km, FROM ANALYSIS OF THE ORBIT OF 1968-59B
D. G. King-Hele and Doreen M. C. Walker Oct. 1968 25 p refs
(RAE-TR-68260) Avail: CFSTI

The satellite 1968-59B was a heavy sphere, of mass 272 kg and diameter 0.61 m, launched by the United States Air Force on 11 July 1968 into a polar orbit with an initial perigee height of 150 km. Despite the low perigee, the satellite remained in orbit for 38 days because of its exceptionally large mass/area ratio, and offers the opportunity of finding values of air density at heights lower than has been possible in previous studies of satellite orbits. Analysis of the orbit gives 28 values of air density, which show that the density increased from 1.49×10^{-9} kg/m^3 at a height of 155 km to 7.9×10^{-9} kg/m^3 at 130 km height. These values are in surprisingly good agreement with the COSPAR International Reference Atmosphere 1965, being about 9% lower than CIRA. When the values of density are converted to a fixed height near 150 km, the day-to-day variations are found to be remarkably smooth between 12 July and 13 August, the deviations from the mean being less than 4%; but there was a significant increase in density at the time of the increased solar activity centred at 15 August. Author (ESRO)

N69-24354# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOVIET INTERPLANETARY STATION "VENUS-4"
May 1968 24 p Transl. into ENGLISH from Pravda (Moscow), 22 Oct. 1967 p 6–7
(AD-680563; FTD-HT-23-1542-67) Avail: CFSTI CSCL 22/2

On 18 October 1967 the VENUS 4 automatic station successfully penetrated the Venutian atmosphere, carried out the first measurements of its physical and chemical properties, and

descended smoothly to the surface of the planet. VENUS 4 was launched 12 June 1967. Findings regarding the Venutian atmosphere were: (1) No magnetic field; (2) Concentration of charged particles in the investigated region of the upper atmosphere did not exceed 1,000 particles per cubic centimeter; (3) Presence of neutral hydrogen; (4) Measured data on the temperature, pressure, and chemical composition; (5) Carbon dioxide constitutes the basic component; and (6) High pressure, density, and temperature levels. Author (TAB)

N69-24441# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astro Physics Lab.

LARGE-SCALE EVOLUTION OF THE LUNAR SURFACE

L. B. Ronca and R. R. Green Nov. 1968 35 p refs Presented at the Geol. Soc. of Am., Mexico City, 11–15 Nov. 1968

(AD-680222; DI-82-0073) Avail: CFSTI CSCL 3/2

The first part of the paper describes the relationship between the erosional stage of craters and the crater areal density. It is shown that class 2 and 3 craters are progressively more abundant as the crater areal density increases, while craters of class 4 and 5 are more abundant with decreasing crater areal densities. The second part of the paper presents a method for relatively dating large lunar areas. In the final part of the paper a geological model is developed in order to explain age differences in the terrae. The model calls for rejuvenation of lunar terrains, caused by the seismic waves and ballistic sedimentation resulting from large impacts. The area surrounding Mare Orientale is cited as an example of a terrain so affected. TAB

N69-24458# Deutsch Versuchsanstalt fur Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

A PROGRAM FOR SATELLITE ORBIT PREDICTION [EIN PROGRAMM ZUR SATELLITENBAHNVORHERSAGE]

E. Baeger and R. Schimmel Jan. 1969 49 p refs In GERMAN; ENGLISH summary

(DLR-Mitt-69-01) Avail: CFSTI

For the observation of earth satellites their topocentric coordinates, e.g. azimuth, elevation, and distances, must be known. This program allows the tabulation, for a given set of orbital elements and a given station, the azimuth, elevation, and distance data for the time the satellite is visible. The program may run on any electronic computer for which an Algol compiler is available. Author

N69-24521*# Stanford Univ., Calif. Electronics Labs.

PROTONOSPHERIC ELECTRON CONCENTRATION PROFILES. Final Report

A. V. da Rosa and O. K. Garriott Mar. 1969 51 p refs

(Contract NASr-136)

(NASA-CR-100778; SU-SEL-68-044) Avail: CFSTI CSCL 04B

The local electron concentration was calculated along portions of the orbit of OGO-1, based on differential Doppler frequency and Faraday polarization rotation measurements of harmonic radio beacon transmissions. Since it is not possible to make these calculations with sufficient accuracy for most satellite orbits, an extensive error analysis is included, to establish the sources and magnitudes of the uncertainties in the computations. Values of protonospheric electron concentration were obtained between altitudes of about 6000 and 15000 km on a number of orbits. The uncertainties in the computed values result principally from scaling errors in the Faraday polarization rotation angle and from horizontal gradients in the ionosphere; they typically total less than ±600 electrons/cm^3. A number of concentration profiles are shown and are compared with direct probe measurements, with whistler results and with extrapolated values of electron concentration obtained from Alouette I near 1000 km. Author

N69-24652*# Martin Co., Denver Colo.

C & SM LUNAR ORBITAL SCIENCE STUDY, VOLUME 2 Final Report

Oct. 1968 476 p refs

(Contract NAS9-8343)

(NASA-CR-99615; PR-34-113-Vol 2) Avail: CFSTI CSCL 03B

Experiment descriptions are provided for studies made in the following areas: metric and stellar camera, panoramic camera, laser altimeter, radar altimeter, geochemistry, mass spectrometer, IR mapping radiometer, IR spectrometer, microwave radiometer, RF transponder, bistatic radar, photoelectric photometer, RF reflectance, electromagnetic measurement, radio noise survey, radar imager, meteoroids, solar wind foil, dc magnetometer, ac magnetometer, plasma probe, electric field, low energy particles, solar energetic particles, UV spectrometer, laser retroflector, gravity gradiometer, and swept frequency UHF radiometer. Cost and schedule estimates are included for each of the experiments. For Volume 2, see accession number N69-23520. P.A.B.

N69-24669# Brandeis Univ., Waltham, Mass. Dept. of Physics.

RESEARCH IN ASTROPHYSICS

Jack S. Goldstein Oct. 1968 13 p refs

(Contract AF 19(628)-4019)

(AD-680415; AFCRL-68-0584) Avail: CFSTI CSCL 3/2

A summary is given of work accomplished in five general categories: (1) The fluid motions of planetary nebulae including radiative transfer aspects of the problem. (2) The evaporation of stars from clusters, and their dynamical history, including the problem of secular stability of such systems. (3) Problems of gravitational instability and condensation of stellar systems. (4) Properties of waves in dense plasmas, including the effects of screening by degenerate electrons on the rates of possible nuclear reactions. (5) Properties of shock waves in attenuated media, especially in attenuated plasmas. Subsidiary related work is also reported. A full bibliography of this work is included. In addition, unpublished work is described in the following subjects: (a) A variational principle for the stability of star clusters. (b) The electrodynamics and statistical mechanics of equilibrium plasmas. (c) The transport properties of magnetoplasmas. Author (TAB)

N69-24741# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE MORNING STAR REVEALS ITS SECRETS

A. O. Oparin May 1968 8 p Transl. into ENGLISH from Pravda (Moscow), 20 Oct. 1967 p 3

(AD-680586; FTD-HT-23-1534-67) Avail: CFSTI CSCL 3/2

The Soviet station, by its smooth descent to the surface of Venus, has enriched science with valuable information, which for the first time will provide insights into many of the secrets of this planet of enigmas. Correspondents from Pravda and TASS have called upon scientists such as: V. I. Siforov and Yu. N. Parivskiy to comment on the results of the investigations carried out by the Venus 4. Their comments on the Venutian atmosphere and other data obtained by the Venus 4 Venus probe are reported in this article. TAB

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N69-23532*# Planning Research Corp., Los Angeles, Calif.
EIGHTH RELIABILITY ASSESSMENT FOR THE ORBITING GEOPHYSICAL OBSERVATORIES, ADDENDUM
28 Jun. 1968 30 p refs
(Contract NAS5-9443)
(NASA-CR-100682; PRC-R-1055A-Add) Avail: CFSTI CSCL 22B

The monthly failure reviews to monitor the performance level in hardware development, fabrication, and test procedures during the report period are summarized. Participation in the OGO E launch readiness review and the OGO F pre-environmental critique is reported, as well as the design review of the Momentum Control Assembly for OGO F. No significant problems were detected in these activities. A brief review of the in-orbit failure rates for the OGO spacecraft and the "transmitter" anomaly of OGO V is reported; the observed failure rates are generally lower than those used in prediction activities. A possible source of the OGO V transmitter difficulties and a potential solution to the problem are suggested. A brief summary of the entire independent reliability assessment activity on the OGO project is presented. Author

N69-23585*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
ANALYSIS AND DESIGN OF A CAPSULE LANDING SYSTEM AND SURFACE VEHICLE CONTROL SYSTEM FOR MARS EXPLORATION Progress Report, 1 Jul.–31 Dec. 1968
D. K. Frederick, P. K. Lashmet, G. N. Sandor, C. N. Shen, E. J. Smith et al
15 Feb. 1969 77 p refs
(Grant NGC-33-018-091)
(NASA-CR-100685; RPI-MP-3) Avail: CFSTI CSCL 22C

Investigation of problems related to the landing and controlling of a mobile planetary vehicle according to a systematic plan of exploration of Mars was undertaken. Problem areas receiving consideration included: updating of atmosphere parameters during entry, adaptive trajectory control, unpowered aerodynamic landing, terrain modeling and obstacle sensing, vehicle dynamics and attitude control, and chromatographic systems design concepts. Author

N69-23789# Joint Publications Research Service, Washington, D. C.
SOVIET COSMONAUT TRAINING, SPACE VEHICLE TESTING
31 Mar. 1969 8 p Transl. into ENGLISH from Nedelya (Moscow), 19 Jan. 1969 p 4–5
(JPRS-47744) Avail: CFSTI

CONTENTS:

1. COSMONAUT-TRAINING PROGRAM I. Ilin p 1–6 (See N69-23790 12-31)
2. DEVELOPED ON EARTH: TESTED IN OUTER SPACE Yu. Nesamidz p 7–8 (See N69-23791 12-31)

N69-23790# Joint Publications Research Service, Washington, D. C.
COSMONAUT-TRAINING PROGRAM
I. Ilin *In its* Soviet Cosmonaut Training Space Vehicle Testing 31 Mar. 1969 p 1–6 (See N69-23789 12-31)
Avail: CFSTI

Soviet cosmonaut training, with particular reference to the space experiment in which two cosmonauts transferred from Soyuz 5 to Soyuz 4 while flying in a 200 km orbit, is discussed. The two principal factors which have to be considered in all space training programs are the problems of high vacuum and weightlessness. The specimen are required to become accustomed to the spacesuits which protect against the outer space vacuum and to develop the necessary habits of motion and the ability to perform purposeful tasks under the conditions of weightlessness. Suspended in the air, the trainees record given texts, take food, and exercise to develop movement coordination. To train for a space walk, the cosmonauts have to learn how to control their bodies in open space and how to leave the lock and return to it. For this purpose, a spacecraft mockup complete with hatch was placed in the laboratory aircraft. In order to provide training for the actual spacecraft transfer experiment, mockups of two spacecraft were set up in the aircraft fuselage. The spacemen practiced the transfer exercises, finding that it was easiest to exit head first and enter feet first. Much attention was paid to the exactness of assignment execution and the alertness of the cosmonauts in the transfer. P.A.B.

N69-23791# Joint Publications Research Service, Washington, D. C.
DEVELOPED ON EARTH: TESTED IN OUTER SPACE
Yu. Nesamidz *In its* Soviet Cosmonaut Training Space Vehicle Testing 31 Mar. 1969 p 7–8 (See N69-23789 12-31)
Avail: CFSTI

Systems testing and development for the spacecraft Soyuz 4 and Soyuz 5, with reference to human factors, are described. Comprehensive studies were carried out in a spacecraft mockup equipped with real life support systems. This made it possible to simulate flight conditions and to evaluate accurately the functioning of the systems. The spacecraft was hooked up in an analog computer system which, together with dynamic setups and control elements, assured the modelling of spacecraft flight control and of cosmonaut emotional and physical stresses. Human work capability, air regeneration and conditioning, water supply, food, sanitation, medical control, flight clothing, and personal hygiene were studied. P.A.B.

N69-24038*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ATLAS-AGENA FLIGHT PERFORMANCE FOR THE APPLICATIONS TECHNOLOGY SATELLITE ATS-1 MISSION
Washington May 1969 97 p refs
(NASA-TM-X-1784) Avail: CFSTI CSCL 22B

Flight performance is discussed from liftoff through the final attitude maneuver. The Atlas–Agena vehicle systems performed satisfactorily throughout the flight, including the standard Agena clamshell shroud which was used for the first time to provide aerodynamic shielding for the spacecraft during ascent through the atmosphere. Aerospace ground equipment operated properly during the countdown and launch, except that the 2-inch motion switch failed at liftoff, and the time of first motion had to be derived from the 8-inch motion switch. Detailed discussions are included on the following aspects of the flight: (1) trajectory and performance; (2) Atlas vehicle system performance; (3) Agena spacecraft system performance; and (4) launch operations. In addition, evaluation of the final Agena transfer orbit parameters demonstrated that these were within the requirements established for the ATS-1 mission. A.C.R.

N69-24137# Royal Aircraft Establishment, Farnborough (England).
THE ION ENGINE AND LARGE SOLAR ARRAY FOR THE X-9 SPACECRAFT
B. P. Day and F. C. Treble Aug. 1968 28 p refs Presented at the 1st Ann. Meeting of Brit. Intern. Soc., Southampton, Engl. 24–25 Apr. 1968
(RAE-TR-68191) Avail: CFSTI

A description is given of the ion engine and the 550 W deployable solar array proposed for the Black Arrow X5 spacecraft. Problem areas are discussed and an indication is given of the present state of development. Author (ESRO)

N69-24172*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APOLLO–SATURN 5 FLIGHT SAFETY PLAN VEHICLE AS-504
22 Feb. 1969 20 p
(NASA-TM-X-61652; K-V-05.13/4) Avail: CFSTI CSCL 22B

This Flight Safety Plan presents flight safety requirements, restrictions, and instrumentation necessary for each launch. The plan defines flight safety responsibilities of the Air Force Eastern Test Range and Kennedy Space Center. The requirements for flight termination and propellant dispersion are described, and the restrictions and instrumentation applicable for each Apollo/Saturn 5 flight are listed. The plan is applicable during the launch countdown and powered flight of the vehicle up to orbit insertion. Author

N69-24224*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
A SUMMARY OF MAJOR NASA LAUNCHINGS Technical Report, 1 Oct.–30 Sep. 1968
William A. Lockyer, Jr. Oct. 1968 115 p
(NASA-TM-X-61650; GP-381) Avail: CFSTI CSCL 22D

Major NASA launchings conducted under the direction of John F. Kennedy Space Center (or its antecedents) from both the Eastern and Western Test Ranges are tabulated. The report is broken down into projects within broad mission categories, with each project being treated chronologically. Each mission has been labeled with the classification S (Successful) or U (Unsuccessful). In a successful mission, the primary mission objectives were accomplished. Unsuccessful indicates that the objectives of the mission were not obtained, although even those launches may have provided some collateral information. These are arbitrary classifications, made after a comparison of objectives and actual results. Author

N69-24294# Royal Aircraft Establishment, Farnborough (England).
THE ORBIT OF COSMOS 137 ROCKET (1968-117B) DETERMINED BY PROP
R. M. Wyatt Sep. 1968 15 p refs
(RAE-TR-68236) Avail: CFSTI

The R.A.E. orbit determination program, PROP, is used to determine the orbit of Cosmos 137 rocket (1968-117B) at 10 epochs in February 1967, April–May 1967 and August 1967, using mainly visual observations. A value for the rotational speed of the atmosphere is obtained from the orbit. Author (ESRO)

N69-24295# Royal Aircraft Establishment, Farnborough (England).
TABLE OF SPACE VEHICLES LAUNCHED DURING THE DECADE 1958–67
H. Hiller Aug. 1968 17 p refs
(RAE-TR-68222) Copyright Avail: CFSTI

All known space vehicles launched before 1 January 1968, excluding satellites in geocentric orbits, are tabulated here. Details are given of mass, size, shape, orbit, time of launch and other useful information. The table is divided into three sections, under the headings: heliocentric orbits, orbits in the Earth-Moon system, and selenocentric orbits. Author (ESRO)

N69-24346# White Sands Missile Range, N. Mex. Atmospheric Sciences Research Office.
PERFORMANCE CHARACTERISTICS AND WIND EFFECTS FOR THE AEROBEE 150 WITH VAM BOOSTER
Mary Ann B. Seagraves and Barry Butler Sep. 1968 46 p refs
(AD-680175; ECOM-5208) Avail: CFSTI CSCL 19/7

Trajectories were simulated, and wind effects were computed for the Aerobee 150 with the VAM-17 and VAM-20 boosters using a five-degree-of-freedom trajectory simulation program on the IBM 7094 computer. Performance characteristics and theoretical functions for ogive and cone-cylinder nose cone configurations are presented for payloads varying from 150 to 500 pounds and for effective launch elevation angles of 85 degrees to 88 degrees. Author (TAB)

N69-24399# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRANSMISSION FROM 'LUNA-11'
May 1968 6 p Transl. into ENGLISH from Pravda (Moscow), 28 Sep. 1966 p 2
(AD-680575; FTD-HT-23-1515-67) Avail: CFSTI CSCL 22/2

The Soviet Luna-11 lunar probe was designed to continue the investigation of the moon and near-lunar space which previous vehicles of this type began. The trajectories of Luna-11 and Luna-10 are compared. Special instruments on the Luna-11 were designed to determine the chemical elements of the lunar surface and to observe long-wave cosmic emission. Other transmitting instruments were designed to provide data on the concentration of meteor streams and their distribution, and the intensity of hard corpuscular radiation near the moon during the circumlunar orbit. Most of the equipment and instruments of the Luna-10 probe were somewhat modified for the Luna-11 lunar probe. TAB

N69-24428# White Sands Missile Range, N. Mex. Atmospheric Sciences Research Office.
A PRACTICAL FIELD WIND COMPENSATION TECHNIQUE FOR UNGUIDED ROCKETS
Gordon L. Dunaway Aug. 1968 31 p refs
(AD-680177; ECOM-5208) Avail: CFSTI CSCL 4/2

An accurate and rapid wind compensation technique for the field determination of launcher settings for unguided rockets is presented. The method was tested with a five-degree-of-freedom trajectory simulation program using several observed wind profiles. The results of five computer tests for an Aerobee 150 show that the maximum theoretical impact miss was 3.8 statute miles when the theoretical impact displacement was 147.4 statute miles. In three tests for an Athena (two-stage), the maximum theoretical impact miss was 5.4 statute miles when the theoretical impact displacement due to the wind was 141.8 statute miles. Author (TAB)

N69-24486# Air Force Systems Command, Wright-Patterson AFB, Cleveland, Ohio. Foreign Technology Div.
ON THE SPACE PIER
P. Bereshev May 1968 19 p Transl. into ENGLISH from Pravda (Moscow), 19 Oct. 1967 p 3
(AD-680670; FTD-HT-23-1535-67) Avail: CFSTI CSCL 22/1

Designer Mikhail Kirillovich takes the author on a tour of the plant where VENUS 4 was built. He discusses the research, capabilities, and events which preceded the VENUS 4 interplanetary station report when the VENUS 4 reached the Venutian atmosphere on 18 October 1967. Author (TAB)

N69-24686# General Accounting Office, Washington, D. C.
REVIEW OF THE SATURN S-4B-503 STAGE ACCIDENT UNDER THE APOLLO PROGRAM
15 Apr. 1969 54 p
(B-156556) Avail: CFSTI
An investigation of the circumstances leading up to the accidental destruction, on January 20, 1967, of the Saturn launch vehicle S-4B-503 stage, with an estimated total loss of $13.3 million, is reported. The cause of the explosion is attributed to the use of nonspecification weld wire in the fabrication of high pressure titanium spheres used to store helium. The findings and conclusions of a review, undertaken to determine whether the accident was related to deficiencies in the quality assurance systems of the organizations involved, are presented. Recommendations made by the General Accounting Office for improvements in quality control are included.
P.A.B.

N69-24687# Kaman Avidyne, Burlington, Mass.
VALIDITY OF DETAILED BALLOON SOUNDINGS IN BOOSTER VEHICLE DESIGN
Garabed Zartarian and John H. Thompson Oct. 1968 124 p refs
(Contract F19628-68-C-0205)
(AD-680418; SR-1; AFCRL-68-0606) Avail: CFSTI CSCL 22/4
Two Balloon/range radar systems capable of obtaining detailed wind profiles are evaluated from the viewpoint of structural design requirements for launch vehicles and missiles. The aerodynamic and dynamic response characteristics of Rose and Jimsphere balloons to sinusoidal and constant gradient wind fields are determined to define their limitations as wind sensors. Sources and extent of the major measurement errors due to the radar operation, including atmospheric conditions and the balloon trajectories and surface conditions, are discussed and estimated. Two previously proposed and applied techniques for reducing noisy balloon position coordinate data into wind profiles are critically reviewed and compared. Selected wind profiles, from some recent soundings analyzed by the University of Dayton Research Institute, were examined to substantiate some of the anticipated results from Rose and Jimsphere systems. Author (TAB)

N69-24692*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SATURN 5 LAUNCH VEHICLE, FLIGHT EVALUATION REPORT AS-503, APOLLO 8 MISSION
20 Feb. 1969 560 p
(NASA-TM-X-61651; MPR-SAT-FE-69-1) Avail: CFSTI CSCL 22D
This report presents the results of the early engineering flight evaluation of the AS-503 launch vehicle. The contents are centered on the performance evaluation of the major launch vehicle systems, with special emphasis on failures, anomalies, and deviations. Summaries of launch operations and spacecraft performance are included for completeness. Separate summaries and specific data are given for trajectory; S 1C, S 2, and S 4B propulsion; hydraulic systems; structures; guidance and navigation; control system; separation; electrical networks; range safety and command systems; emergency detection system; vehicle pressure, acoustic, and thermal environments; data systems and vehicle aerodynamics and mass characteristics. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N69-23448*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESPONSE OF AN INFINITE ELASTIC PLATE TO AXISYMMETRIC INITIAL VELOCITY DISTRIBUTIONS WITH APPLICATION TO HYPERVELOCITY IMPACT
Robert J. Hayduk Washington Apr. 1969 29 p refs
(NASA-TN-D-5118) Avail: CFSTI CSCL 20K
Classical plate theory is used to study the response of an infinite plate to an axisymmetric initial velocity distribution over a central region. The expression for the bending stress is reduced to a single definite integral which depends upon the initial velocity distribution. The deflection is reduced to the Hankel inversion integral for three example distributions: conical, cylindrical, and spherical. The analysis indicates that the conical distribution causes larger stresses at the origin and deflections of the plate at short times after initiation than either the spherical or cylindrical distribution. A simple relationship is derived for the failure thickness of an elastic plate responding to an axisymmetric initial momentum, monotonically decreasing in the radial direction. The failure-thickness relationship is shown to correlate with available experimental hypervelocity impact data where the initial momentum was induced by disk projectiles of various diameters. Author

N69-23454# National Aeronautical Establishment, Ottawa (Ontario). Structures and Materials Section.
A HIGH PRECISION TRIANGULAR PLATE-BENDING ELEMENT
G. R. Cowper, E. Kosko, G. M. Lindberg, and M. D. Olson Dec. 1968 72 p refs
(NRC-10627; NAE-LR-514) Avail: CFSTI
A fully conforming, displacement-type, finite element of triangular shape is developed and applied to the solution of several problems in the bending of plates. The deflection is represented by a fifth degree polynomial in the Cartesian coordinates of the mid-plane. Six deflection parameters, namely the displacement and its first and second derivatives, are specified at each vertex, yielding a total of 18 degrees of freedom for the element. Examples treated include static and dynamic analyses of a square plate with edges simply supported or clamped; statics of a triangular, simply supported plate; and vibrations of cantilevered triangular plates. Rates of convergence of the finite element approximations are investigated both theoretically and numerically. Excellent accuracy is achieved in all cases, and the rates of error convergence agree closely with predicted asymptotic values. Author

N69-23485 North Carolina State Univ., Raleigh.
A NONLINEAR INTEGRO-DIFFERENTIAL EQUATION ASSOCIATED WITH A CLASS OF WEDGE PROBLEMS
George Marvin Eargle (Ph.D. Thesis) 1968 78 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-14649
The Mellin integral transform is used to investigate the displacement near the vertex of an infinite, isotropic, elastic wedge in a state of plane stress under mixed boundary conditions. Normal stresses are prescribed near the vertex and normal displacements are assumed to be zero elsewhere along the boundary. A nonlinear integro-differential equation is derived in which the unknown function is related to the desired displacement. This and a related nonlinear algebraic system are analyzed. Methods are developed to compute the solution for the special case of the wedge of vertex angle π. These methods are extended to a more general wedge and an example of the more general computation is given.
Dissert. Abstr.

N69-23518*# Advanced Kinetics, Inc., Costa Mesa, Calif.
DESIGN, DEVELOP AND DELIVER SPLIT COIL FOR SWAGING HASTELLOY AND STAINLESS STEEL TUBING
Final Report
25 Jan. 1969 173 p refs
(Contract NAS8-20970)
(NASA-CR-98383) Avail: CFSTI CSCL 20K

The manipulation of two dimensional conducting boundaries by means of intense magnetic fields was investigated in some detail both theoretically and experimentally during the course of this NASA-George C. Marshall Space Flight Center high energy fabrication program. The treatment of magnetic stresses applied to cylindrical boundaries was lacking and no useful engineering data are yet available for the swaging of metallic tubings. The main purpose of this program is to provide the necessary theoretical foundations for this operation with particular emphasis on the use of high resistivity materials, such as stainless steel and Hastelloy. In addition, accurate magnetomotive stress–strain relationships are given for the first time for aluminum, stainless steel, and Hastelloy tubings of different sizes and wall thickness. Prototype hardware developed for NASA for the magnetic swaging of such tubings in three sizes is also described. Author

N69-23633 Syracuse Univ., N. Y.
PLANE-STRESS ANALYSIS OF AN EDGE-STIFFENED RECTANGULAR PLATE, TAKING INTO ACCOUNT BENDING AND SHEAR STIFFNESS OF THE STIFFENERS
Yu-wen Hsu (Ph.D. Thesis) 1968 181 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-13834

A plane-stress analysis, by means of Fourier series, is presented for an isotropic or orthotropic elastic rectangular plate bounded by four uniform edge stiffeners and subjected to any prescribed temperature distribution and boundary loads. In this analysis, both the extensional and flexural (including transverse shear) stiffnesses of the stiffeners are considered, and the possibility is included that the plate is attached to the stiffeners along lines which are offset from their centroidal axes. At each corner the junction between the two meeting stiffeners is assumed to consist of a hinge and a coil spring such that any degree of joint rigidity can be simulated. This work presents a generalization of an earlier one in which the stiffener flexural stiffness was neglected, and the plate was assumed to be attached to the stiffeners along their centroidal axes. Dissert. Abstr.

N69-23637 Oklahoma Univ., Norman.
NONLINEAR VIBRATIONS OF A CONTINUOUS ELASTIC SYSTEM
John Delbert Ray (Ph.D. Thesis) 1968 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-13568

The vibration of a continuous elastic system with geometric nonlinearity is investigated both theoretically and experimentally, in order to determine the validity of the normal mode principle for the solution of nonlinear equations of motion derived for a vibrating system. The elastic system selected is a simply supported beam with a fixed distance between supports. The beam is designed to emphasize the nonlinearity caused by the stretching of the beam and to minimize secondary effects. Different approaches are presented for the solution of the nonlinear partial differential equation of motion derived for the system. The values determined in the solutions are the resonant frequency, modal shape, waveform, and stress distribution. In the experiments, the beam is base excited. The resonant frequency, strain distribution, modal shape, waveform, and initial tension load is measured for various values of amplitude ratio. Dissert. Abstr.

N69-23645 Texas A&M Univ., College Station.
A COMPLIANCE ANALYSIS FOR SYMMETRICALLY LOADED ORTHOTROPIC AND RIB-REINFORCED CIRCULAR CYLINDRICAL SHELLS
Paul Ray Corder (Ph.D. Thesis) 1968 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-11449

A system of equations is developed which will relate three of the four elastic constants of an orthotropic circular cylindrical shell to the geometrical configuration and material properties of an isotropic circular cylindrical shell reinforced with longitudinal ribs of rectangular cross-section. Once the displacements of the orthotropic and rib-reinforced shells have been formulated, the strain energies are calculated and equated assuming a symmetrical uniformly distributed load. Consideration is also given to the equality of displacements at a point. From the resulting system of equations, expressions for the orthotropic elastic constants in terms of the geometry and elastic properties of the actual shell are determined. A numerical analysis of the relations is made with the aid of the digital computer. Dissert. Abstr.

N69-23697*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FORCES ON A FLEXIBLE SHELL DURING WATER IMPACT
David A. Hamilton Washington May 1969 30 p refs
(NASA-TM-X-1781) Avail: CFSTI CSCL 20K

Water impact tests were conducted with a 1/4-scale model of the Apollo command module. The tests were made to observe loads on the heat shield and at the center of gravity of the model. Results showed the nature of the loading on the center of gravity and related the loading to the heat-shield accelerations and the water pressure force. Author

N69-23704 Polytechnic Inst. of Brooklyn, N. Y.
NONLINEAR VIBRATIONS OF SHALLOW SPHERICAL SHELLS
Perry I. Grossman (Ph.D. Thesis) 1968 130 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-16245

The nonlinear vibrations of shells having finite deflection are investigated with emphasis on the transition from a flat plate to a curved shell. The combined effects of curvature and nonlinearity are studied for both free and forced axisymmetric motions of spherical caps with various types of edge conditions. Based on a generalized variational equation of motion, a complete and consistent system of nonlinear dynamic equations is derived for elastic spherical shells. The resulting equations are employed to study the nonlinear axisymmetric vibrations of shallow spherical shells by a procedure consisting of a systematic sequence of variational approximations with respect to space and time. Numerical results show that for caps with relatively small curvature, including the degenerate case of a flat circular disc, the nonlinearity is of the hardening type. However, for large enough curvature, the nonlinearity becomes of the softening type, the transition taking place at a value of the rise of the shell smaller than its thickness. Thus, while the frequency of free oscillation increases with the curvature of the spherical cap, it is less pronounced in the nonlinear case. Dissert. Abstr.

N69-23732 Rensselaer Polytechnic Inst., Troy, N. Y.
SURFACE DISPLACEMENTS ON THE END OF A SEMI-INFINITE CIRCULAR CYLINDER
Edward Arthur Wilson (Ph.D. Thesis) 1968 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-13530

The problem of finding the surface displacements on the end of a semi-infinite, circular cylinder due to an axisymmetric ring of forces on the end, with the further condition of no boundary tractions on the lateral surface is considered. The solution which has been found may then be used to find surface displacements for general axisymmetric loadings by superposition. The solution, in tabular form, is given as corrections to the corresponding half-space solution. The method of solution involves a succession of superposition processes. First, the radial normal and shear stresses in a half-space due to a ring of forces is found by numerically integrating the Boussinesq solution. Second, the excess tractions in the half-space, over that of the cylinder, are removed. This step is done by first solving for the normal stress σ_z on the $z = 0$ plane of an infinite cylinder loaded on the lateral surface by linearly varying bands of pressure and shear over a short length of the lateral surface. Dissert. Abstr.

N69-24056*# Oklahoma Univ., Norman. School of Aerospace and Mechanical Engineering.
AN APPROXIMATE THEORY FOR TRANSVERSE SHEAR DEFORMATION AND ROTATORY INERTIA EFFECTS IN VIBRATING BEAMS
D. M. Egle Washington NASA May 1969 19 p refs
(Grant NGR-37-003-035)
(NASA-CR-1317) Avail: CFSTI CSCL 20K

A beam theory, which includes the effects of transverse shear deformation and rotatory inertia, and whose kinetic and potential energy may be written in terms of a single dependent variable, is developed in this paper. This simplification will reduce the computational effort required in the analysis of complex beams or structures composed of a number of beams. This is accomplished by neglecting the coupling between the transverse shear deformation and the rotatory inertia. Comparisons of natural frequencies calculated by this theory with those of the Timoshenko theory show that this coupling is indeed negligible. Author

N69-24131*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BUCKLING OF THIN-WALLED TRUNCATED CONES
V. I. Weingarten (Univ. of Southern Calif.), and P. Seide (Univ. of Southern Calif.) Sep. 1968 32 p refs
(NASA-SP-8019) Avail: CFSTI CSCL 20K

Practices are recommended for predicting buckling of uniform stiffened and unstiffened circular conical shells under various types of static loading, and procedures are suggested that yield estimates of static buckling loads which are considered to be conservative. Isotropic and orthotropic shells are discussed with respect to axial compression, bending, hydrostatic pressure, torsion, and combined loads. Sandwich shells with isotropic and orthotropic face sheets are investigated, and expressions are given for failures due to core crushing, intracell buckling, and face wrinkling. N.E.N.

N69-24202# Whittaker Corp., San Diego, Calif. Narmco Research and Development Div.
ORTHOTROPIC ANALYSIS OF TUBULAR STRUCTURE Final Report, Supplement
Alberto Puppo and Juan Hasner Jul. 1968 89 p refs
(Contract DAAA21-67-C-0228)
(AD-682708; Rept-305-2) Avail: CFSTI CSCL 19/6

The problem of determining elastic constants of an orthotropic material is analytically investigated. It is shown that, contrary to previous thoughts on the matter, a cross-shaped specimen is not suitable for such an analysis. Instead, a multi-fiber reinforced thin tube is competitive with that of the cross-shaped specimen, and the computation of stresses from external load presents no problem (in other words, the stresses are completely independent of fiber geometry). In the present investigation, a Fortran program to determine engineering elastic constants is established and is appended to this report. Author (TAB)

N69-24308# California Inst. of Technology, Pasadena. Div. of Engineering and Applied Science.
SOME RESULTS IN THE LINEAR DYNAMICAL THEORY OF ANISOTROPIC ELASTIC SOLIDS
Lewis T. Wheeler Nov. 1968 24 p refs
(Contract Nonr-220(58))
(AD-680260; TR-17) Avail: CFSTI CSCL 20/11

This investigation deals with theoretical issues related to unbounded anisotropic media in the context of linearized elastodynamics. The results established concern the prolonged quiescence of the far field in an initially quiescent body, as well as appropriate uniqueness and reciprocal theorems. Author (TAB)

N69-24310# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
THE FORMULATION OF THEORIES IN GENERALIZED CONTINUUM MECHANICS AND THEIR PHYSICAL SIGNIFICANCE
Ronald S. Rivlin Sep. 1968 29 p refs
(Contract N00014-67-A-0370)
(AD-682984; CAM-100-4) Avail: CFSTI CSCL 20/11

The nature of the passage from a particle or a structured model to a continuum is discussed. In the first case the model consists of particles, each of which consists of a number of mass-points. It is seen that the continuum theory for such a system may depend in form on the manner in which the deformation of the system of particles is described. Doubt is cast on the value of continuum theories in which the significance of the various tensors or vectors describing the deformation is not explicitly given. Another model in which a composite material consists of blocks of material obey the laws of ordinary continuum theory is also discussed. The main implication of this discussion is to raise questions regarding the interpretation of continuum theories in which stress depends on higher order spatial derivatives of the displacement than the first. Author (TAB)

N69-24364# Goodyear Aerospace Corp., Akron, Ohio.
FABRICATION AND TESTING OF THE COMPOSITE MATERIALS AIRCRAFT WING SECTION Final Report
Fred E. Bauch, Robert W. Nordlie, and Robert C. Lair Sep. 1968 211 p refs
(Contract DA-44-177-AMC-407(T))
(AD-680286; GER-13857; USAAVLABS-TR-68-66) Avail: CFSTI CSCL 1/3

A 7-foot-long aircraft wing test section was fabricated with fiber glass reinforced plastic materials and subjected to static and dynamic tests. Good correlation between predicted and actual test values was obtained. Author (TAB)

N69-24376# Weidlinger (Paul) Consultants, New York.
INVESTIGATION OF GROUND SHOCK EFFECTS IN NONLINEAR HYSTERETIC MEDIA. REPORT 1: DEVELOPMENT OF MATHEMATICAL MATERIAL MODELS
Ivan Nelson and Melvin L. Baron Mar. 1968 87 p refs
(Contract DACA39-67-C-0048)
(AD-680323; AEWES-CR-5-68-1) Avail: CFSTI CSCL 19/4

A historical outline of mathematical models used previously to represent soil and rock behavior in ground shock computations at low pressure levels is presented. The problems and deficiencies of these early approaches are discussed. Subsequently, two types of models are developed; one a plastic model in which the yield condition depends on the mean stress and in which different variable bulk moduli are used in loading and unloading. The second type of model, called the variable bulk moduli model, has variable shear as well as moduli, but no explicit yield condition. The behavior of both types of model in uniaxial strain and triaxial compression tests is examined. Author (TAB)

N69-24380# Aerospace Corp., El Segundo, Calif. Lab. Operations.
FRACTURE MECHANICS IN COST-EFFECTIVE PRESSURE VESSEL DESIGN
Louis Raymond and Raymond J. Usell, Jr. Los Angeles SAMSO Aug. 1968 36 p refs
(Contract F04701-68-C-0200)
(AD-680392; TR-0200(4250-10)-6; SAMSO-TR-68-447) Avail: CFSTI CSCL 21/8.1

The report presents a demonstration of how the concepts of fracture mechanics can be used in the design and fabrication of boosters from commercial steels and commercial fabrication techniques. Minimal nondestructive testing quality control procedures are required to avoid compromising reliability. Example calculations are given that demonstrate the materials selection processes consistent with a program to design the booster stage of future space launch vehicles on a minimum cost basis. Present major cost items with high strength/weight materials that can be minimized are the exotic fabrication techniques and rigid quality control procedures need to ensure reliability. Author (TAB)

N69-24438# Franklin Inst., Philadelphia, Pa. Research Labs.
STATIC AND DYNAMIC VISCOELASTIC BEHAVIOR OF FIBER REINFORCED MATERIALS AND STRUCTURES Final Report
Z. Hashin, M. A. Brull, T. Y. Chu, and Z. Zudans Oct. 1968 136 p refs
(Contract DAAJ02-67-C-0050)
(AD-680285; F-C2041; USAAVLABS-TR-68-70) Avail: CFSTI CSCL 11/4

Time-dependent properties of uniaxially fiber reinforced materials composed of linear viscoelastic matrix and elastic fibers are investigated. Sample calculations are given for the static and dynamic properties of a viscoelastic fiber reinforced material. In addition, the behavior of fiber reinforced viscoelastic structures is investigated, and a number of practical problems for beams, plates, and shells, subjected to static and dynamic loadings, are analyzed. Author (TAB)

N69-24489# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
USE OF LAMINATED ANISTROPIC TUBES FOR DETERMINING THE MECHANICAL PROPERTIES OF FIBER REINFORCED COMPOSITE MATERIALS Final Report, Dec.–May 1968
J. M. Whitney and J. C. Halpin Oct. 1968 21 p refs
(AD-680053; AFML-TR-68-218) Avail: CFSTI CSCL 11/4

Using Donnells approximations, the analysis of a laminated anisotropic tube under combined tension or compression, internal pressure, and torque is presented. Results show that a tube clamped at one end while free to rotate at the opposite end can be used to completely characterize the mechanical properties of a fiber reinforced composite material. Author (TAB)

N69-24513# Bolkow Entwicklungen K. G., Munich (West Germany).
APPLICATION OF THE MATRIX DISPLACEMENT METHOD TO STRUCTURAL ELEMENTS OF GLASS-FIBER REINFORCED PLASTIDS [ANWENDUNG DER MATRIZENVERSCHIEBUNGSMETHODE AUF GFK-BAUTEILE]
G. Malejannakis 13 Nov. 1968 140 p refs In GERMAN
(DF-87-O; F-270) Avail: CFSTI

Basic equations of elastic theory for anisotropic continuums are used to determine the elastic constant for an anisotropic body with inner elastic property changes from point to point. A matrix displacement is then applied to develop a computer program for calculating volumetric stress distributions in glass-fiber reinforced plastic structural members consisting of materials with differing elastic properties. Transl. by G.G.

N69-24546# California Univ., La Jolla. Dept. of the Aerospace and Mechanical Engineering Sciences.
EXPANSION OF A HOLE IN A DISK WITH KINEMATIC HARDENING Research Report
Jenn-Ming Chern Jan. 1969 29 p refs
(Contract N00014-67-A-0109)
(AD-682544; TR-29) Avail: CFSTI CSCL 20/11

A complete solution is obtained for the enlargement of a circular hole in a disk using Pragers kinematic hardening law with Trescas yield function and its associated flow rule. The governing equations are reduced to a second order quasilinear differential equation. Detail results are given and comparison is made with the results obtained for the isotropic hardening law. Author (TAB)

N69-24555# California Univ., La Jolla. Dept. of the Aerospace and Mechanical Engineering Sciences.
MINIMUM WEIGHT DESIGN OF ELASTIC SANDWICH BEAMS WITH DEFLECTION CONSTRAINTS
N. C. Huang and H. T. Tang Nov. 1968 46 p refs
(Contract N00014-67-A-0109; Grant DA-ARO(D)-31-124-G1008)
(AD-680041; TR-27) Avail: CFSTI CSCL 20/11

Minimum weight design of an elastic sandwich beam with a prescribed deflection constraint at a given point is investigated. The analysis is based on geometrical considerations using the n-dimensional space of discretized specific bending stiffness. Since the present method of analysis is different from the method based on the calculus of variations, the conditions of piecewise continuity and differentiability on specific bending stiffness can be relaxed. Necessary and sufficient conditions for optimality are derived for both statically determinate and statically indeterminate beams. Beams subject to a single loading and beams subject to multiple loadings are analyzed. The degree to which the optimality condition renders the solution unique is discussed. To illustrate the method of solution, two examples are presented for minimum weight designs under dual loading of a simply supported beam and a beam built in at both ends. The analysis is also extended to the following problems: (i) optimal design of a beam built in at both ends with piecewise specific stiffness and a prescribed deflection constraint, and (ii) minimum cost design of a sandwich beam with prescribed deflection constraints. Author (TAB)

N69-24605# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
STRESS CONCENTRATION FACTORS AROUND A PENETRATION IN A STRIP OR SLAB OF FINITE DIMENSIONS
J. M. O'Connell Nov. 1968 12 p refs Submitted for publication
(RD/B/N-1152) Avail: AEC Depository Libraries

Experimental and theoretical examinations of the stress concentration effect of openings in pressure vessels are often carried out on rectangular slabs of finite width. The errors involved in using a penetration in a finite width slab to simulate penetration in a much larger area are examined. Such errors are particularly critical in the examination of openings in concrete vessels, due to the susceptibility of the material to cracking at relatively low values of tensile stress. Author (NSA)

N69-24640# Washington Univ., Seattle. Dept. of Mechanical Engineering.
APPLICATION OF THE METHOD OF FINITE ELEMENT ANALYSIS TO TWO-DIMENSIONAL PROBLEMS IN FRACTURE MECHANICS
A. S. Kobayashi, D. E. Maiden, B. J. Simon, and S. Iida Oct. 1968 24 p refs
(Contract Nonr-477(39))
(AD-680456; TR-5) Avail: CFSTI CSCL 20/11

The method of direct stiffness is used to determine stress intensity factors for two-dimensional fracture mechanic problems of practical interest. For most problems, the crack opening displacement about three nodal positions away from the crack tip was used to determine the stress intensity factor within a projected accuracy of plus or minus 5%. The requirement of extremely small finite elements in the vicinity of the crack tip is circumvented and the amount of computational effort is reduced. Stress intensity factors obtained by this method include the double cantilever specimen, notched cylinder with internal pressure, edge-notched square plate with prescribed edge displacements, and the tension plate with slanted cracks. Author (TAB)

N69-24749# Naval Research Lab., Washington, D. C.
FRACTURE DATA ON PROSPECTIVE ALLOYS FOR DEEP SUBMERGENCE AND SPACE APPLICATIONS
Fred R. Stonesifer and Herschel L. Smith Nov. 1968 20 p refs
(AD-680021; NRL-Memo-1933) Avail: CFSTI CSCL 20/11

Explorations into the ocean and space demand structural materials of higher fracture toughness and strength-to-weight ratio. Nickel-steels and titanium alloys appear promising for such applications. This report presents fracture toughness data obtained through nearly 600 tests performed on specimens from 134 plates of materials in these two classes. Author (TAB)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N69-23351*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ON THE DESIGN OF ACOUSTIC LINERS FOR ROCKET ENGINES: HELMHOLTZ RESONATORS EVALUATED WITH A ROCKET COMBUSTOR
Bert Phillips, Ned P. Hannum, and Louis M. Russell Washington Apr. 1969 28 p refs
(NASA-TN-D-5171) Avail: CFSTI CSCL 21B

A study was made to improve the design of rocket engine acoustic liners. Helmholtz resonators with variable cavity depth were tested with an unstable rocket combustor. Combustor pressure oscillations inside the resonators and in the combustor and the phase angles between them were measured. From these measurements resonator aperture effective lengths were calculated. A new correlation for the effective lengths at high mean gas velocities is presented. A nonlinear resonator model is evaluated and used to calculate the aperture resistance. The calculated resistances were correlated by an empirical function of the mean and oscillating flows. Author

N69-23379 Oregon State Univ., Corvallis.
AN EXPLICIT FINITE-DIFFERENCE SOLUTION FOR NATURAL CONVECTION IN AIR IN RECTANGULAR ENCLOSURES
Bruno Richard Pagnani (Ph.D. Thesis) 1968 188 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-14485

An explicit finite-difference formulation of the general momentum and energy equations was developed for a constant property, transient natural convective system. This technique was successfully applied to the vertical rectangular enclosure problem. Computer solutions for this problem were obtained for an aspect ratio of five, over a Rayleigh number range of $3 - 10^3$ to $25 - 10^5$. Additional solutions, for an aspect ratio of ten, are also included for comparison with existing experimental data. Computed steady state temperature profiles were in close agreement with the experimental data. Dissert. Abst.

N69-23420 Oklahoma Univ., Norman.
RADIATIVE TRANSPORT PROPERTIES OF FLAMES
Yih-Wan Tsai (Ph.D. Thesis) 1968 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-14194

The aim of this work is to provide a method to predict the total heat flux from a flame which has specific size and geometry. The transport equation was used to determine the volume emission coefficient, J_λ and the volume extinction coefficient, β_λ based on the laboratory measurements. J_λ and β_λ were obtained on the assumption that average values could be used, and the average values were measured by viewing the outer cone of the flame. A new and improved technique was used in which the flame size was varied during the experiments. Data for methanol, natural gas, acetone, n-hexane, cyclohexane, and benzene were provided. Total heat fluxes from large fires predicted by using the J_λ and β_λ values from small laminar flames were compared to radiometer readings. Atmospheric absorption and the transmittance of the quartz window of the radiometer were taken into consideration in the total predicted heat flux integration. Dissert. Abst.

N69-23471*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VIEW FACTORS FOR TOROIDS AND THEIR PARTS
Norman T. Grier and Ralph D. Sommers Washington Apr. 1969 88 p refs
(NASA-TN-D-5006) Avail: CFSTI CSCL 20M

Various radiation view factors for a toroid have been calculated using a high-speed digital computer. The results are presented in graphs and tables. The view factors included are: (1) between differential elements and bands on a toroid, (2) between differential- and finite-sized elements, (3) between finite-sized elements and the whole toroid, and (4) between a toroid and itself. The range of toroidal parameters used was such that all possible toroids are included in the calculations. Orthogonal toroidal coordinates were used in the computer calculation. Toroidal coordinates and their use in writing the view factor equations are discussed. Author

N69-23479 Missouri Univ., Rolla.
A STUDY OF FILM BOILING OF LIQUID NITROGEN AND LIQUID ARGON OVER A WIDE PRESSURE RANGE WITH CYLINDRICAL HEATERS
Virgil James Flanigan, Jr. (Ph.D. Thesis) 1968 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-14044

A film boiling heat transfer study was conducted with three different diameter cylindrical copper heaters over a wide range of pressures for nitrogen and argon with the heat transfer surface in the horizontal position. The data were compared to the commonly used film boiling heat transfer relations. The common relations were found to be considerably in error for the range of variables covered in this investigation. A semi-empirical equation for corresponding states fluids which correlates the available data as a function of the reduced temperature and reduced pressure was derived and discussed. Dissert. Abstr.

N69-23482 Carnegie-Mellon Univ., Pittsburgh, Pa.
THERMODYNAMICS BASED ON A WORK POSTULATE
William Alan Day (Ph.D. Thesis) 1968 78 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-10706

This dissertation gives a new axiomatic approach to the thermodynamics of a wide class of simple materials with fading memory. The viewpoint adopted here is that a theory essentially equivalent to Coleman's can be obtained by making an assumption about the work done in certain processes in place of assuming the Clausius-Duhem inequality. It is supposed that the constitutive functional S for the generalized stress is given and corresponds, in a certain sense, to materials which behave elastically in fast and slow process and have fading memory. We also make one assumption of a thermodynamic nature. The formulation of this assumption requires that we define the concept of a closed connection. Dissert. Abstr.

N69-23588# California Univ., Berkeley. Lawrence Radiation Lab.
AN ABSOLUTE TEMPERATURE SCALE FOR CERIUM MAGNESIUM NITRATE BELOW 0.002 DEG K
James John Huntzicker (Ph.D. Thesis) Sep. 1968 170 p refs
(Contract W-7405-ENG-48)
(UCRL-18476) Avail: CFSTI

The absolute temperature scale for single-crystal cerium magnesium nitrate (CMN) was extended to $S/R = 0.0002$ by adiabatic demagnetisation from values of H/T up to 68 kOe/°K. The temperature dependence of the highly anisotropic angular distribution of the 225-keV γ ray from oriented ^{137m}Ce in the CMN provided the thermometric parameter. Analytic relations between temperature and entropy are presented for the entropy range $0.002 \leq S/R \leq 0.640$. The lowest temperature measured was 0.00135 ± 0.00008°K. These results and the calorimetric results of Hudson and Kaeser are compared in detail. The effect of recent high-field magnetization measurements on the CMN temperature scale are discussed. The ^{137m}Ce γ thermometer was also used to investigate the thermal behavior of cerium zinc nitrate (CZN). The preliminary nuclear orientation results indicate a high degree of similarity between CZN and CMN. Author (NSA)

N69-23631*# Hayes International Corp., Birmingham, Ala.
PREDICTION OF THE SATURN S-2 BASE RADIATION ENVIRONMENT
Aug. 1967 98 p refs
(Contract NAS8-21028)
NASA-CR-98335; ER-1469) Avail: CFSTI CSCL 20M

Thermal radiation from rocket exhaust plumes can be a major heating source for the base region of launch vehicles. To provide analytical methods of predicing the radiative flux to this region, the Marshall Space Flight Center has sponsored a series of research studies. This research has led to the development of a method of analysis based on random or statistical band models with a modified Curtiss-Godson approximation for application to inhomogeneous gases. The purpose of this report is to describe the application of the analytical methods to the flux prediction for the S-II state of the Saturn V launch vehicle. The report concerns itself with three areas of investigation: (1) a method of specifying the gas properties of the exhaust plume for the five-nozzle configuration; (2) a limited investigation of a means of reducing computation time; and (3) the prediction of the radiative flux at selected points in the base region of the S-II stage. The computer program was developed to numerically evaluate the radiation heat transfer. Author

N69-23647 Lehigh Univ., Bethlehem, Pa.
BOILING HEAT TRANSFER IN VERTICAL UPFLOW AND DOWNFLOW TUBES
Luis Pujol (Ph.D. Thesis) 1968 287 p
Avail: Univ. Microfilms: HC $13.05/Microfilm $3.70 Order No. 68-15915

A heat transfer system was built, and an investigation conducted in which both non-boiling and boiling heat transfer coefficients were measured in a test section consisting of two upward and two downward lengths, formed by bending a half inch pipe, approximately twenty feet long, in three equally spaced locations. The results are given in graphical form as well as in equations. They reveal that the differences between boiling heat transfer coefficients in upflow and downflow pipes are negligible in the nucleation suppressed region, but can be substantial in the nucleate boiling region, with higher heat transfer coefficients being measured in the upflow legs. The heated test section had, in addition to the four straight lengths, three 180 degrees bends in which the heat transfer coefficients were investigated. Total pressure drop graphs are also presented. Dissert. Abstr.

N69-23707*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND FABRICATION OF A COUNTERFLOW DOUBLE-CONTAINMENT TANTALUM-STAINLESS STEEL MERCURY BOILER
Laurence W. Gertsma and David W. Medwid Washington May 1969 38 p refs
(NASA-TN-D-5092) Avail: CFSTI CSCL 20M

A boiler was designed using 7 tantalum (Ta) tubes for containment of the mercury with each Ta tube placed inside a

flattened stainless steel tube. These tubes were coiled, bundled, and inserted into a coiled, large diameter stainless steel tube which contains the primary NaK. The large difference in thermal expansion between the Ta and the stainless steel tubes was accommodated by the flattened stainless steel tube allowing the Ta tube to radially move with respect to the stainless steel tube. All tubes were equalized in length by uniformly twisting the tube bundle 360° Author

N69-23778 Arkansas Univ., Fayetteville.
THE EFFECTS OF AXIAL CONDUCTION AND ARBITRARY FLUX ON HEAT TRANSFER AT LOW PECLET NUMBERS (IN PARALLEL PLATE CHANNELS WITH UNIFORM AND PARABOLIC VELOCITY PROFILES)
Sonny Wayne Pearson (Ph.D. Thesis) 1968 238 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 68-15574

A three zone, parallel plate model was employed having an arbitrarily specified axial heat flux imposed on one wall of the central zone; all other walls were adiabatic. The analytical analysis for the slug flow case resulted in an infinite series expression. A modification of existing superposition techniques was employed to extend a known uniform heat flux solution to account for arbitrary flux distributions. An independent solution by application of finite Fourier cosine transforms yielded an identical solution. The series expressions were evaluated for the following flux distributions: uniform heat flux, skewed sine fluxes with different peak flux locations, and a sixth order polynomial flux approximation of the Southwest Experimental Fast Oxide Reactor (SEFOR). Finite difference techniques were employed to obtain numerical results for fully developed laminar flow. Dissert. Abstr.

N69-23779 Stevens Inst. of Tech., Hoboken, N. J.
THE MECHANISM OF FLAME SPREADING OVER THE SURFACE OF IGNITING CONDENSED PHASE MATERIALS
Richard Stephen Magee (Ph.D. Thesis) 1968 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-16220

It is postulated that the advancing flame vaporizes the surface material lying before it. As these vapors diffuse away from the surface, they undergo an exothermic reaction with the gaseous environment, and ignite; thus, flame spreading is viewed as continuous diffusive, gas phase ignition. Subjecting a simplified version of the conservation equations to dimensionless group analysis has yielded a prediction of flame spreading velocity dependence on two gas phase parameters: pressure and reactive component mole fraction and the length of surface ahead of the flame that experiences significant heating. Surface temperature distributions and flame spreading velocities were measured for a variety of solid materials in O_2/He, O_2/N_2 and O_2/Ar environments between 4 and 415 psia. Well defined experimental conditions yielded reproducible results and thus suggest that flame spreading velocity is an intrinsic combustion quantity. Dissert. Abstr.

N69-23793# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
ENERGY BALANCE OF FUSING SILVER WIRES SURROUNDED BY AIR
L. Vermij and J. E. Daalder Nov. 1968 83 p refs
(TH-68-E-05) Avail: CFSTI

Investigations are carried out regarding the behavior of the resistance of a silver wire from the moment the wire evaporates completely, considering the expension stage of the metal vapor. The work is restricted to cylindrically shaped silver wires, melted and evaporated by a strong electric current, supplied by a circuit with a low ringing frequency. Energy balanced equations are discussed and experimental techniques and results are presented. Author

N69-23894*# Boeing Co., Seattle, Wash.
ANALYSIS OF THE APOLLO HEAT SHIELD PERFORMANCE. VOLUME 1: ANALYTICAL METHODS
Richard S. Gaudette, Eduardo P. del Casal, David W. Halstead, and Vladimir Deriugin Mar. 1969 117 p refs
(Contract NAS9-7964)
(NASA-CR-99633; D2-114433-1) Avail: CFSTI CSCL 20M

Areas considered were internal chemical reactions, effects of property uncertainties on ablator performance including shear removal, thermal conductivity, emissivity, carbon deposition, etc., and effects of deviations from one dimensional matrix flow. The kinetics of surface reactions and carbon deposition received special attention and mathematical models were established accounting for deposition rates as functions of temperature. An existing computer program was used to incorporate the required modifications for achieving improved ablation performance prediction and to provide the necessary analytical data for comparison with existing flight data. Correlations obtained during a previous study were verified, improved, and incorporated in a simplified program independent correlation routine which can be used in various existing programs. An improved ablator performance prediction method was developed as a result of this study. Author

N69-23962# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.
CONCERNING THE THEORY OF UNSTEADY THERMAL EXPLOSIONS
V. V. Barzykin et al Dec. 1968 20 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 3, 1964 p 118–125
(AD-680313; PA-TT-151) Avail: CFSTI CSCL 20/13

An analysis was made and a solution was found with the aid of an electronic computer for a system of equations for thermal explosions; it is given in partial derivatives for reactions of the zero and first order with heat transfer by conduction in the zone of the reaction and a Newton heat exchange at the boundary. The basic characteristics of thermal explosions are exactly determined. The obtained results are presented in the form of approximate expressions connecting the characteristics of the thermal explosion with all parameters of the problem for a wide range of changes. A criterion is given for the applicability of the averaged volume of the equation for calculating the period of induction, in case the heat transfer in the reacting volume takes place by conduction. A method is offered for averaging the system of equations of thermal explosions. Author (TAB)

N69-23958# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
COLLECTIVE OSCILLATIONS IN He-3-He-4 MIXTURES Research Communication No. 69
Richard D. Etters and John C. Raich (Colorado State Univ.) Aug. 1968 33 p refs
(AD-680670; Douglas-Paper-5113) Avail: CFSTI CSCL 20/13

The existence of collisionless phonons in He(3)-He(4) mixtures is predicted on the basis of a self-consistent field calculation. The phonon velocity is calculated for all temperatures over the region $0 < 0 < 1.5K$ and for all molar concentrations of He(3). The velocity is found to increase monotonically with increasing

temperature for all molar concentrations. Significantly, the behavior of these excitations is not overtly sensitive to the state of the superfluid. It is argued that the phonon excitation of pure He(4) and the zero-sound mode of pure He(3) belong to the same branch and evolve continuously into one another as the fractional concentration of He(3) in the mixture changes from zero to unity. The differential inelastic X-ray scattering cross section is also calculated for the mixture. Author (TAB)

N69-24042# Ohio State Univ. Research Foundation, Columbus.
HEAT AND MASS TRANSFER TO A SUBFREEZING SURFACE IN A NON-UNIFORM ELECTRIC FIELD
Teng Hsueh Chuang and Henry R. Velkoff Sep. 1968 191 p refs
(Contract DA-31-124-ARO(D)-246)
(AD-680185; TR-9; AROD-4942.10-E) Avail: CFSTI CSCL 20/23

An experimental and analytical program was undertaken to investigate the behavior of frost formation under an impinging electric wind induced by a positive wireplane corona in a nonuniform electric field. A vertical test plate precooled to subfreezing temperatures was exposed to the ambient air and the effects of electric fields were studied through the application of a high voltage between the grounded test plate and a corona wire. Considerable increases in heat and mass transfer were found. A simple theoretical model was developed for predicting the effects of electric fields upon the heat and mass transfer processes associated with frost formation. Two regions of the flow field created by the impinging electric wind are of primary importance in heat and mass transfer, namely, the stagnation flow and the wall jet regimes. In the stagnation flow, a linear relation for the local heat and mass transfer coefficients was assumed between the stagnation point and the wall jet region. In the wall jet, the analysis was based on laminar flow. An analysis was made of a simplified model of transient heat conduction in a frost layer. Using a method due to Portnoy the position and the temperature of the progressing frost-air interface was obtained in a series expansion in powers of the square root of t. The coefficients up to the power n = 6 were given. Author (TAB)

N69-24074# Deutsche Versuchsanstalt fur Luft-und Raumfahrt, Munich (West Germany).
INVESTIGATIONS ON THE MASS EXCHANGE BETWEEN RECIRCULATION ZONES BEHIND AXISYMMETRIC FLAME HOLDERS AND THE SURROUNDING FLOW [UNTERSUCHUNGEN UEBER DEN MASSENAUSTAUSCH ZWISCHEN RUECKSTROEMGEBIETEN HINTER ROTATIONSSYMMETRISCHEN FLAMMENHALTERN UND DER UMGEBENDEN STROEMUNG]
G. Winterfeld (Ph.D. Thesis—Tech. Hochschule, Aachen, 1968) Feb 1969 128 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-07) Avail: CFSTI

Equations are given which are suitable for the description of the turbulent exchange processes between recirculation zones and the surrounding flow. Methods for the measurement of mean residence times in recirculation zones are discussed. The exchange processes with respect to the measuring methods are investigated theoretically by means of simplified models. The magnitude of the mass exchange and its variation by action of the most essential quantities of influence are discussed using the results of the measurements on the residence times as well as on the shape and size of the recirculation zones. The processes in recirculation zones behind flame holders related to the stabilization of flames are investigated with respect to the results on the turbulent exchange processes. Author

N69-24084# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
ADDENDUM TO FITS TO THERMODYNAMIC PROPERTIES OF WATER
W. B. Jordan 28 May 1968 7 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6734A(WBJ-5)) Avail: CFSTI

Algebraic fits which had previously been made to the thermodynamic properties of water are compared with the newly released official ASME calculations. The comparison shows the fits are satisfactory. A fit to the viscosity of saturated steam is presented. Author (NSA)

N69-24168*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EFFECT OF SIZE ON NORMAL-GRAVITY SELF-PRESSURIZATION OF SPHERICAL LIQUID HYDROGEN TANKAGE
John C. Aydelott and Charles M. Spuckler Washington, May 1969 42 p refs
(NASA-TN-D-5198) Avail: CFSTI CSCL 20M

A study was conducted to obtain a correlating parameter which would relate the rate of pressure rise to the volume of spherical liquid hydrogen tankage. A nonventing 22 inch diameter spherical tank partially filled with liquid hydrogen was subjected to four uniformly heated self-pressurization tests with various combinations of percent filling and heat transfer rate. These data were compared with data from a similar study on a 9 inch diameter, uniformly heated, spherical tank. The two sets of data verified the analysis which predicted the same change in pressure in each tank for equal values of heat added per unit volume. Author

N69-24182*# National Aeronautics and Space Administration, John F. Kennedy Space Center, Cocoa Beach, Fla.
DETERMINATION OF THE MINIMUM ELECTROMAGNETIC FIELD INTENSITY REQUIRED TO IGNITE A HYDROGEN-AIR GASEOUS MIXTURE Interim Report
David L. Lester 1 Sep. 1968 14 p refs
(NASA-TM-X-61653; TR-740) Avail: CFSTI CSCL 21B

Results are presented of a study to determine experimentally the electromagnetic field intensity necessary to ignite a gaseous mixture of hydrogen-air encompassing two elements of a dipole antenna. The elements were intermittently connected and disconnected, producing a spark which was not of sufficient energy to cause combustion of the mixture. Author

N69-24186# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
THERMODYNAMIC STUDIES ON HEAVY ELEMENTS AND STUDIES IN NUCLEAR CHEMISTRY Annual Report, Feb. 1968–Jan. 1969
J. W. Cobble, ed. Jan. 1969 15 p refs
(Contract AT(11-1)-1716)
(COO-1716-6) Avail: CFSTI

Research progress is reported on: ternary fission of ^{236}U by ^{3}He ions, angular distribution of ^{28}Mg from ternary fission of U with ^{4}He ions, ternary fission of ^{232}Th with 40-MeV ^{4}He ions, ternary fission in ^{197}Au and ^{209}Bi, search for ternary fission products in the spontaneous fission of ^{252}Cf, and thermochemical studies on heavy element and rare earth chlorides. NSA

N69-24490# General Research Corp., Santa Barbara, Calif.
SOME STRONG WAVE PROBLEMS IN AN ELASTIC MATERIAL WITH MICROSTRUCTURE Final Technical Report, 18 May 1967–17 Jun. 1968
C. W. Bert and B. E. Cummings Jun. 1968 60 p refs
(Contract DAAD05-67-C-0484)
(AD-680236; CR-0484-1) Avail: CFSTI CSCL 20/11

The historical development of the foundations of thermomechanics is reviewed, with emphasis placed upon the critical contribution of each investigator. The theories are discussed in terms of their relevance to real materials in the important high-velocity regime which lies between the low and intermediate velocity regime (which involves essentially isothermal elastic and plastic wave propagation) on one hand and the ultrahigh-velocity regime (in which a hydrodynamic description of the material behavior is adequate) on the other. Various facets of high-velocity wave propagation in various materials involve elastic, plastic, viscous, and thermal effects on a macroscopic scale and perhaps on a microscopic scale. Evaluations are made from the standpoint of thermodynamics as well as classical mechanics. Using fundamental principles of thermodynamics and mechanics, thermomechanically coupled linear energy and constitutive equations are derived for the elastic solid with micro unit cells discussed by Mindlin. Equations of motion for the microstructure are found for the large amplitude case where Eulerian and Lagrangian formulations are not identical. Author (TAB)

N69-24525# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.
DETERMINING THE SPECIFIC HEATS OF GASES AT HIGH PRESSURES
A. A. Matveenko Nov. 1968 15 p refs Transl. into ENGLISH from Khim. Prom. (Leningrad), v. 16, no. 9, 1939 p 23–26
(AD-680312; PA-TT-144) Avail: CFSTI CSCL 20/13

As is known, the specific heats of gases under high pressures may be determined directly from experiment and calculated according to P, V, and T. In most cases, the determination of specific heats on the basis of experimental data is not feasible owing to the complexity of calculations and ponderosity of apparatus. The present work deals with an indirect method of determining the numerical values of specific heats, which is currently being worked on by a group of investigators (Shmidt, Deming, Shupe and others). The indirect method was found to be much simpler and more accurate than the direct method, since it completely eliminates graphic representation. A proportionality factor is used to maintain equality between the right- and left-hand sides of the equation PV = RT and curves of the compression factor as a function of temperature and pressure are developed and used. Author (TAB)

N69-24584# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DETERMINATION OF HEAT-TRANSFER COEFFICIENTS IN A TUBE FROM THE TEMPERATURE DISTRIBUTION ON THE CONTOUR OF THE TUBE CROSS SECTION
V. K. Shchukin Oct. 1968 19 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), v. 7, no. 3, 1964 p 96–105
(Contract NOw-62-0604)
(AD-680686; APL-CLB-3-T-570) Avail: CFSTI CSCL 20/13

The heat transfer of a fluid in a tube with an axisymmetric temperature field is discussed. A method is proposed for determining the heat-transfer coefficients in the case of an arbitrary temperature distribution at any face of a contour. Using a modified zero-order Bessel function of the first kind and applying the Fourier method, an expression is obtained for the n-th term of a series, accurate to within a constant factor. The method can also be applied to studies of external longitudinal flow about tubes. Author (TAB)

N69-24577# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
PART OF THERMAL NON-EQUILIBRIUM IN BOILING CO-CURRENT FLOW
H. Wundt 8 Aug. 1968 26 p refs
(EUR-4188) Avail: AEC Depository Libraries

Elementary mechanisms of thermal nonequilibrium in boiling processes were considered with emphasis on the radial temperature and vapor distributions in co-current gas–liquid flow through a heated vertical tube. Vapor may be considered to be at saturation temperature in a boiling co-current flow. However, when the liquid is superheated near the wall; its temperature falls toward the tube axis. The amount of liquid superheat as well as nucleation frequency depend on the surface roughness. For rough surfaces the liquid temperature is sufficiently flat so that no major problems occur in defining a liquid temperature. With smooth surfaces troubles may occur because of pronounced nonequilibrium states with latent vapor retention. NSA

N69-24582# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
AN IMPROVED DIFFERENTIAL APPROXIMATION FOR RADIATIVE TRANSFER WITH SPHERICAL SYMMETRY
Stephen C. Traugott Nov. 1968 41 p refs
(Contract AF 49(638)-1726)
(AD-680394; AIAS-TR-68-16C; AFOSR-68-2840) Avail: CFSTI CSCL 20/13

An improved closure condition is used to construct a purely differential equation which, with associated boundary conditions, describes radiative transfer with spherical symmetry. The method is equivalent in degree of complexity to the P4 moment approximation, that is, a spherical harmonic expansion retaining four terms. The improved closing conditions are especially constructed to allow both isotropic radiation and unidirectional, beam-like radiation. The method is applied to the problem of radiative equilibrium of a grey gas between two concentric black spheres maintained at different temperatures. Both radiative heat flux and temperature distribution from the present model are compared to known exact results, and it is shown that trends are correctly predicted by the improved differential approximation in the crucial limit of transparent gas and small inner sphere compared to outer. This is in contrast to both the conventional P2 and P4 moment approximations, which predict qualitatively incorrect results in this limit. Author (TAB)

N69-24589# Aerospace Corp., El Segundo, Calif. Lab. Operations.
RADIATIVE ENERGY TRANSFER FROM A SMALL SPHERE Technical Report, Apr.–Jun. 1968
George Emanuel Oct. 1968 29 p refs
(Contract F04701-68-C-0200)
(AD-680390; TR-0200(4240-20)-1; SAMSO-TR-68-443) Avail: CFSTI CSCL 20/13

The emissive power and radiant heat flux are determined for a single sphere in a quiescent nonconducting grey gas when the radius of the sphere is small compared to a photon mean free path. It is shown by the method of matched asymptotic expansions that the leading term of the inner solution, which is valid near the sphere, corresponds to the solution with an optically thin gas. The leading term of the outer solution is for a point source in an infinite medium. Neutron transport theory provides the solution to this problem. A uniformly valid first approximation is found for the emissive power, while the first two approximations are determined for the heat flux. A comparison is made with other approximate and numerical solutions. Author (TAB)

N69-24651*# Boeing Co., Seattle, Wash.
ANALYSIS OF THE APOLLO HEAT SHIELD PERFORMANCE. VOLUME 2: CHAD COMPUTER PROGRAM
David W. Halstead, Richard S. Gaudette, Eduardo P. del Casal, and Vladimir Deriugin Apr. 1969 193 p refs
(Contract NAS9-7964)
(NASA-CR-49634) Avail: CFSTI CSCL 20M

The one dimensional CHAD (charring ablation with diffusion) computer program, a machine independent program written in FORTRAN 4, provides an ablation analysis of more sophistication than previous programs by including multiple internal reactions and internal diffusion. Surface recession is determined, and profiles of temperature, densities, gas flow rate, internal pressure, and gas concentrations are calculated. The CHAD program is a modification of the successfully CHAP program; it was developed to examine parameters such as permeability, diffusivity, char-density changes, char-deposition reaction, and the silica–carbon reaction. Although it is rather specific to studying the Apollo heat shield performance, it provides a good basis for a more generalized ablation performance prediction program. The assumptions and limitations of the program are summarized, and the mathematical model used is discussed, along with the governing equations and the procedure of solution. Input-output data, operating instructions, and programming information, including program design, nomenclature, and main routine and subroutine descriptions, are given. Sample cases illustrate the program. (For Volume 1, see accession number N69-23894.) P.A.B.

N69-24735# Argonne National Lab., Ill.
THERMODYNAMIC PROPERTIES OF SOME CHALCOGEN FLUORIDES
P. A. G. O'Hare Jul. 1968 95 p refs
(Contract W-31-109-ENG-38)
(ANL-7315) Avail: CFSTI

Physical and thermodynamic data are presented for 24 gaseous fluorides of the oxygen-group elements. Data are also included for the liquid and solid states where enthalpies of vaporization and fusion are available. The thermodynamic functions $-G^0-H^0_0)/T$, $(H^0-H^0_0)/T$, S^0, C^0_p, $H^0-H^0_{298}$, ΔHf, ΔGf, and log Kf are tabulated from 0 to 2000°K. Author (NSA)

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N69-23748# RAND Corp., Santa Monica, Calif.
BIG TECHNOLOGY, THE TECHNOLOGY GAP, AND A DANGEROUS POLICY PITFALL
Richard R. Nelson Mar. 1968 19 p refs Presented at the 6th Goddard Mem. Symp., Washington, D. C., 4–5 Mar. 1968
(P-3795) Avail: Issuing Activity

The alleged technology gap between Europe and the United States is discussed in terms of its meaning and existence, its evidence as a long standing phenomenon, and its connection with big science. It is argued that, while the technology gap does exist in a wide variety of fields, aside from defense and space it probably has much less to do with U. S. big science than is commonly throught. Association of U.S. economic progressivity with large government financed research and development programs may, in addition to being mistaken, lead Europeans to unwise use of considerable resources. The potential dangers to Americans of a technology race for its own sake are discussed. It is stated that such a race is not only meaningless but extremely expensive, leaving little to allocate to more tangible interests. P.A.B.

N69-23855# Joint Publications Research Service, Washington, D. C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 201
1 Apr. 1969 114 p Transl. into ENGLISH from Russian Publications
(JPRS-47760) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1–15 (See N69-23856 12-30)
2. METEOROLOGY p 16–43 (See N69-23857 12-20)
3. OCEANOGRAPHY p 44–60 (See N69-23858 12-13)
4. TERRESTRIAL GEOPHYSICS p 61–74 (See N69-23859 12-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 75–99 (See N69-23860 12-13)

N69-24440# Joint Publications Research Service, Washington, D. C.
PROBLEMS OF THE DISTRIBUTION OF PRODUCTION
V. A. Yemelichev et al 1 Apr. 1969 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR (Minsk), v. 12, no. 10, 1968 p 869–873 Submitted for publication
(JPRS-47763) Avail: CFSTI

A mathematical discussion is presented on the economic problem of distributing products. N.E.N.

N69-24451*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
A SELECTIVE LIST OF ACRONYMS AND ABBREVIATIONS
28 Oct. 1968 52 p
(NASA-TM-X-61616; GP-589) Avail: CFSTI CSCL 05B

A list containing acronyms, abbreviations, initials, code words, and phrases generally used at the Kennedy Space Center is presented. Over 2600 entries are included. P.A.B.

N69-24528# Illinois Univ., Urbana. Materials Research Lab.
MATERIALS SCIENCES RESEARCH Annual Technical Report, 1967–1968
Jan. 1969 173 p refs
(Contract SD-131)
(AD-680450) Avail: CFSTI CSCL 20/12

The report contains abstracts on materials research done by the University of Illinois: Experimental research on the properties of materials at very low temperatures; Theory of the condensed state of matter; Magnetic and optical studies of intermetallic coupling; Nucleation and crystal growth in simple glass systems; Optical properties and band structure of insulating crystals; Anodic spark deposition of oxide ceramics; Molecular rearrangements of organic compounds in the solid state; Vibration-rotation

spectroscopy of molecules and ions trapped in crystal lattices; Electronic structure of metallic alloys; Experimental studies of superconductors; Luminescence, laser, and oscillation effects in compound and elemental semiconductors; Dielectric and semiconducting solids; Properties of recombination centers in semiconductors; Experimental studies of Type II superconductivity; Paramagnetic relaxation and dynamic nuclear polarization; Dielectric and structural investigation of complex compounds of the Perovskite type ABO3; Electrical properties and phase equilibria in electrically conducting oxides; and others. TAB

N69-24579# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GENERAL RESEARCH Quarterly Technical Summary Report, 1 Aug.–31 Oct. 1968
Frederick C. Frick, V. Alexander Nedzel, Stephen H. Dodd, Melvin A. Herlin, Herbert G. Weiss et al 26 Dec. 1968 52 p refs
(Contract AF 19(628)-5167)
(AD-680221; ESD-TR-68-331) Avail: CFSTI CSCL 5/2

This Quarterly Technical Summary covers the period from 1 August through 31 October 1968. It consolidates the reports of Division 2 (Data Systems), Division 3(Radio Physics), Division 4(Radar), Division 7(Engineering), and Division 8(Solid State) on the General Research program at Lincoln Laboratory. Author (TAB)

N69-24596# Army Biological Labs., Fort Detrick, Md.
FILTRATION AS A METHOD OF REMOVING MICROBES FROM THE AIR
E. Yu. Zuykova Jul. 1968 4 p refs Transl. into ENGLISH from Gigiena i Sanit. (Moscow), v. 24, no. 6, 1959 p 72–73
(AD-680489; Trans-289) Avail: CFSTI CSCL 15/2

Filtration is one of the simplest and most perspective methods of removing microorganisms that are in suspension in the air. As a result of the tests which were conducted, it was established that the FP type and the membrane filters possess a high filtration capacity in regards to bacterial aerosols which are either in the dust or droplet stage. The filters of the FP type filter an average of 99.998%, and the membrane filters - 99.978% of a bacterial aerosol of Bact. prodigiosum in the droplet phase. The FP type filters are more convenient and simpler in use than the membrane filters and can be recommended for air purification from microorganisms. Author (TAB)

N69-24617# Services Electronics Research Lab., Baldock (England).
SERL TECHNICAL JOURNAL, VOLUME 19, NO. 1
Feb. 1969 38 p refs
Avail: CFSTI

CONTENTS:

1. A HIGH-POWER C.W. RING-BAR TRAVELLING-WAVE TUBE M. O. Bryant and F. E. Wray 7 p refs (See N69-24618 12-07)

2. A BROAD-BAND WAVEGUIDE WINDOW FOR HIGH-POWER MICROWAVE TUBES P. H. Cross 9 p ref (See N69-24619 12-07)

3. HOLOGRAPHIC RECORDING ON PHOTOSENSITIV' IODIDE FILMS M. R. Tubbs (Warwick Univ., Engl.), M. J. Beesley, and H. Foster 7 p refs (See N69-24620 12-14)

4. GALLIUM ARSENIDE THIN FILM PHOTOCATHODES C. H. A. Syms 12 p refs (See N69-24621 12-09)

N69-24655# National Bureau of Standards, Washington, D. C.
REPORT OF THE 53d NATIONAL CONFERENCE ON WEIGHTS AND MEASURES, 1968
R. L. Koeser, ed. Mar. 1969 182 p Conf. held in Washington, D. C., 17–21 Jun. 1968 *Its* Spec. Publ. No. 311
Avail: SOD $1.25

A report is given of the proceedings of the fifty-third national conference on weights and measures, sponsored by the National Bureau of Standards, held in Washington, D. C., and attended by state, county, and city weights and measures officials and representatives of the federal government, business, industry, railroads, and associations. Author

N69-24660# Air Force Systems Command, Wright-Patterson AFB, Cleveland, Ohio. Foreign Technology Div.
THE OCTOBER REVOLUTION AND SCIENTIFIC PROGRESS
M. Keldysh 20 May 1968 16 p Transl. into ENGLISH from Pravda (Moscow), 25 Oct. 1967 p 2–3
(AD-680351; FTD-HT-23-1570-67) Avail: CFSTI CSCL 5/2

The document states that during the last fifty years the USSR has attained an extraordinarily high level in the development of the national economy, culture, and science. New scientific and engineering disciplines were developed, and scientific research centers were founded. Scientific instrumentation has become the researchers tools. Nuclear physics has discovered Cherenkov radiation, the supervolatility of helium, and the spontaneous division of the nucleus. A greater emphasis is being placed on energy systems, chemistry, data processing, and communications facilities. The high-mountain scientific stations and artificial earth satellites have added much to the theory of cosmic radiation. TAB

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